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A systematic revision of the New World species of *Trypeta* Meigen (Diptera: Tephritidae)

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Abstract. The tephritid genus *Trypeta* is revised for the New World and a key, descriptions, illustrations, and phylogeny provided for the eighteen species recognized: *Trypeta bifasciata*, **sp.n.**, *californiensis*, **sp.n.**, *chiapasensis*, **sp.n.**, *concolor* (Wulp), *costaricana*, **sp.n.**, *denticulata*, **sp.n.**, *flaveola* Coquillett, *flavifasciata*, **sp.n.**, *footei*, **sp.n.**, *fractura* (Coquillett), *inclinata*, **sp.n.**, *maculata*, **sp.n.**, *maculosa* (Coquillett), *melanoura*, **sp.n.**, *reducta*, **sp.n.**, *rufata* (Wulp), *striata* (Wulp), and *wulpi*, **sp.n.** Lectotypes are designated for *Spilographa fractura* Coquillett and *Spilographa maculosa* Coquillett. *Trypeta (Acidia) tortile* Coquillett, *Acidia sigma* Phillips, and *Trypeta angustigena* Foote are synonymized with *Trypeta flaveola* Coquillett. Based upon many specimens, we redefine *Trypeta flaveola* as a widely distributed and morphologically highly variable species. New host plant records are provided for five species, and host data and other information on the biology and immature stages of all of the New World *Trypeta* species are summarized and discussed. Our phylogenetic analysis suggests that the majority of New World *Trypeta* species form a monophyletic group that diversified in the southwestern U.S.A. and Mesoamerica.

Introduction

The genus *Trypeta* Meigen (1803) currently comprises forty-six species distributed mainly in the Holarctic and Oriental regions (thirty-six species listed in the world catalogue by Norrbom *et al*. (1999), plus additional new combinations by Wang (1998) and Han (1999) and new species and synonymy recognized here). All *Trypeta* species with known biologies mine leaves of asteraceous plants (Han, 1998). Leaf-mining behaviour, which is unusual for the family Tephritidae, is restricted to the *Trypeta* group (thirteen genera) plus a few other genera of the subtribe Trypetina and might be synapomorphic for these genera (Han, 1999).

The long and confusing nomenclatural history of the generic name *Trypeta* Meigen (1803), which originally included four specific names ('*arnicae*, *cerasi*, *urticae*, *artemisiae* F., etc.'), was reviewed thoroughly by Foote (1960). The subsequent designation of *T. artemisiae* as the type species of the genus by Coquillett (1910) was accepted by Foote and is followed by the taxonomic community. Because the type species, *T. artemisiae*, and its relatives possess many characters of the general ground plan of the subfamily Trypetinae, there has been great confusion in defining the genus *Trypeta*. Phylogenetic analyses of the tribe Trypetini based on morphological characters (Han, 1992, 1999) allowed a phylogenetic definition of *Trypeta*, and morphology-based hypotheses of the generic relationships within Trypetini have been tested with molecular sequence data (Han & McPheron, 1997; Han, 2000). Despite these efforts, *Trypeta* remains defined loosely as a taxon lacking derived characteristics of other genera within the *Trypeta* group, which includes thirteen closely related genera within the subtribe Trypetina of Trypetini (*sensu* Han, 1999).

Until recently, ten New World species of *Trypeta* were recognized, seven from the U.S.A. and Canada (Foote, 1960) and three from Mexico (Wulp, 1899). Based on the study of many additional specimens unavailable to Foote, Han (1992) suggested that three nominal species (*angustigena* Foote, *inaequalis* Coquillett, and *sigma* Phillips) should be placed in synonymy, and recognized only seven valid species in the New World (see also Norrbom *et al*., 1999). Here we provide justification for this synonymy as

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well as that of *T. tortile* Coquillett and its synonyms under *T. flaveola*, describe twelve additional species, and present the results of a phylogenetic analysis of the eighteen included New World *Trypeta* species. We provide a key to the species, illustrations, and document additional host records.

Materials and methods

Terminology and morphological interpretations follow the glossary of White *et al*. (1999). Additionally, eight ratios are used: frons–head ratio (narrowest width of frons in dorsal view/width of head); eye ratio (shortest eye diameter/longest eye diameter); gena–eye ratio (genal height/longest eye diameter) – genal height is the distance between the ventral eye margin and the ventral genal margin anterior to the genal seta; arista–antenna ratio (length of arista/length of antenna excluding arista); vein R_{4+5} ratio (distance along vein R_{4+5} between crossvein R-M and vein R_{4+5} apex/distance between crossvein R-M and basal node of vein R_{4+5}); vein M ratio (distance along vein M between crossveins R-M and DM-Cu/distance between crossveins R-M and BM-Cu); subcosta–costa ratio (length of pterostigma/length of costal cell, both measured along vein C); wing–thorax ratio (wing length/thorax length). These ratios plus wing and thorax lengths are excluded from descriptions but tabulated (Table 1). Characters were recorded fully for each species initially, but each specific description was shortened by elimination of characters common to the generic description of New World *Trypeta*.

A cladistic analysis of the interspecific relationships within *Trypeta* was conducted using PAUP* (version 4.0b10; Swofford, 2001) with cladograms (Fig. 1) produced with WINCLADA (version 1.00.08; Nixon, 2002).

Acronyms for institutions where specimens are deposited follow Thompson (1999) except for the following institution: YSUW, Department of Life Science, Yonsei University, Wonju Campus, Korea. For the majority of specimens, we included the USNM barcode numbers used in the junior author's New World Tephritid Specimen Database.

Extended distributional information is available under Supplementary Material.

Phylogenetic relationships

Trypeta belongs to the tribe Trypetini, whose monophyly has been tested recently by morphological (Han, 1992, 1999) and molecular phylogenetic analyses (Han & McPheron, 1997; Han, 2000). These studies indicated that *Trypeta* is a member of the primarily Old World *Trypeta* group within the subtribe Trypetina of Trypetini, but that *Trypeta* is recognized on the basis of lacking derived characters of other genera of the *Trypeta* group (Han, 1999), and thus it is possibly paraphyletic. At least one possible monophyletic group within *Trypeta*, containing the type species, *T. artemisiae*, plus a few Palaearctic species and all the New World species (*artemisiae* group hereafter), can be characterized by the reduction of the trumpet-shaped subapical lobe on the glans (Fig. 10A, B vs Figs 10C–H, 11).

We conducted a cladistic analysis of the New World *Trypeta* species, selecting characters showing little to no intraspecific variation, and excluding autapomorphies of individual species (Appendix; Table 2). We included two Old World species with the trumpet-shaped subapical lobe (*T. amanda* and *T. seticauda*; Fig. 10A, B) as outgroups to root the ingroup topology. Within the ingroup, we included all New World *Trypeta* species and five representative Old World *artemisiae* group species for which both sexes were available. All characters were considered unordered with forward and backward changes equiprobable. Character polarities were determined based on the outgroup species, but in the Appendix we have also stated the variation in the analysed characters in the other genera of the *Trypeta* group to provide a more general estimation of their reliability.

The branch-and-bound search procedure of PAUP* (Swofford, 2001) initially recovered twenty-three most parsimonious trees for which the strict consensus tree is shown in Fig. 1A. Successive weighting by maximum values of rescaled consistency indices recovered six most parsimonious trees (strict consensus tree shown in Fig. 1B). The successive weighting procedure placed no weight on characters 3 and 19, and gave low weights to characters 4, 7, 13, 15, 17, 22 and 23. All character state changes for these consensus trees are plotted using the fast optimization option of WINCLADA (Nixon, 2002).

The basal nodes of the phylogeny of New World *Trypeta* are poorly resolved. In both the unweighted and weighted analyses (Fig. 1A, B), the *artemisiae* group is supported by a single synapomorphy, and within the group there is an unresolved polytomy leading to five lineages in the unweighted tree and four in the weighted tree. The New World *Trypeta* species are placed among three of these clades, two of which also include Palaearctic species. If these three clades are each monophyletic, there should have been at least three separate colonizations of the New World by *Trypeta* (or one or two such events with reinvasion of the Palaearctic region).

In one of these clades (Fig. 1), the most widely distributed Nearctic species, *T. flaveola*, which also occurs in eastern Russia, is grouped with the Palaearctic *T. binotata* and *T. zoe* based on a single synapomorphy (character 21.1; internal sculpture pattern of round granulation on medial sclerite of glans with tiny granules closely packed together). A second clade includes the western U.S. species *T. footei* and *T. californiensis*, whose sister-group relationship is supported by at least three unambiguous synapomorphies (Fig. 1B), and the Palaearctic *T. pictiventris*. All three species have unusually short scutellar setae (character 9.1). The successive weighting procedure groups *T. immaculata* with these taxa (Fig. 1B), but this larger clade is weakly supported only by the dark markings on abdominal tergite 4 (character 17.1) with reversal in *T. footei*.

The clade comprising the remaining fifteen New World *Trypeta* species includes no Palearctic species and is

Table 1. Lengths and ratios of *Trypeta* species used in this study. Ratios are explained in the Materials and methods section.

		Lengths (mm)		Ratios							
Species	Sample number	Wing	Thorax	Frons–head	Eye	Gena–eye	Arista–antenna	Vein R_{4+5}	Vein M	Subcosta-costa	Wing–thorax
Old World											
amanda	3♂3♀	5.2–5.5	1.9–2.2	0.36–0.39	0.69–0.73	0.08–0.16	1.5–1.8	2.2–2.5	0.71–0.90	0.70–0.80	2.4–2.7
seticauda	3♂2♀	5.8–7.0	2.2–2.8	0.36–0.39	0.83–0.89	0.17–0.23	1.8–2.0	2.2–2.3	0.69–0.87	0.60	2.6
pictiventris	2♂2♀	5.4–6.0	1.9–2.1	0.46–0.49	0.81–0.86	0.37–0.39	1.5–1.7	2.2–2.3	0.85–0.88	0.50	2.8–2.9
artemisiae	4♂3♀	5.0–5.9	2.1–2.4	0.47–0.51	0.66–0.73	0.20–0.25	1.5–1.8	2.0–2.4	0.64–0.86	0.60	2.3–2.5
binotata	1♂4♀	4.4–5.1	1.7–1.9	0.38–0.43	0.75–0.80	0.13–0.18	1.5	2.4–2.7	0.81–1.18	0.60	2.6–2.9
zoe	4♂3♀	4.5–5.0	1.7–2.0	0.42–0.44	0.72–0.85	0.17–0.26	1.5–1.6	2.6–3.8	0.90–1.40	0.60	2.4–2.7
immaculata	3♂2♀	4.6–5.5	1.7–2.0	0.41–0.44	0.74–0.78	0.16–0.20	1.5–1.6	2.1–2.5	0.78–0.92	0.60	2.5–2.8
New World											
flaveola	9♂10♀	4.7–5.9	1.7–2.2	0.37–0.54	0.67–0.82	0.18–0.39	1.4–1.6	2.0–3.1	0.70–1.2	0.43–0.63	2.5–3.1
footei	1♂3♀	4.6–5.4	1.7–1.9	0.50–0.53	0.78–0.83	0.30–0.46	1.2–1.7	2.1–2.3	0.69–0.86	0.45–0.50	2.5–2.7
californiensis	1♂1♀	4.5	1.7–2.0	0.52–0.55	0.76–0.80	0.30–0.35	1.6–1.7	2.0–2.3	0.68–0.92	0.70	2.2–2.6
fractura	2♂3♀	5.2–6.3	1.8–2.3	0.46–0.49	0.85–0.91	0.24–0.31	1.6–1.7	1.7–2.4	0.48–0.81	0.40–0.50	2.7–2.9
maculosa	2♂3♀	3.9–5.6	1.4–1.9	0.43–0.44	0.87–0.92	0.17–0.21	1.5–1.7	2.8–3.7	1.3–1.5	0.60	2.8–2.9
denticulata	1♂2♀	4.9–5.2	1.8–1.9	0.42–0.44	0.86–1.00	0.19–0.28	1.6–1.7	2.1–2.7	0.86–0.93	0.40	2.7–2.8
reducta	5♂3♀	4.2–4.9	1.4–1.6	0.41–0.48	0.93–0.96	0.22–0.30	1.6–1.7	1.7–2.2	0.50–0.79	0.40	2.9–3.1
concolor	3♂3♀	3.7–4.8	1.4–1.8	0.41–0.47	0.85–0.92	0.17–0.24	1.4–1.6	1.9–2.1	0.58–0.68	0.40	2.6–2.9
rufata	1♂1♀	4.8–5.9	1.6–1.9	0.39–0.43	0.77	0.20–0.21	1.6–1.9	2.6–3.1	0.79–0.84	0.40	3.0–3.2
wulpi	1♂1♀	4.1–5.5	1.6–2.0	0.43–0.46	0.75–0.80	0.23–0.26	1.8	2.7–2.9	0.91–1.0	0.40	2.6–2.8
melanoura	3♂1♀	5.2–5.9	1.7–2.0	0.40–0.42	0.80–0.86	0.24–0.29	1.8–1.9	2.5–3.0	0.76–1.0	0.60	2.9–3.0
bifasciata	1♀	5.4	1.9	0.42	0.81	0.21	1.7	2.3	0.58	0.40	2.9
chiapasensis	1♂	4.7	1.7	0.47	0.77	0.13	1.9	2.6	1.0	0.40	2.7
costaricana	5♀	5.0–5.5	1.9–2.1	0.38–0.39	0.80–0.88	0.17–0.21	1.6–1.9	2.9–3.1	1.0–1.3	0.44–0.50	2.6–2.8
flavifasciata	1♂	4.5	1.5	0.37	0.73	0.16	1.7	2.5	0.86	0.40	2.9
striata	1♀	5.9	2.4	0.38	0.78	0.20	1.6	1.8	0.53	0.50	2.5
inclinata	1♀	6.5	2.2	0.31	0.75	0.14	1.7	1.1	0.19	0.72	2.9
maculata	1♂2♀	6.1–6.7	2.1–2.5	0.37–0.43	0.70–0.73	0.11–0.21	1.6–1.8	1.2–1.4	0.12–0.17	0.55–0.65	2.6–2.9

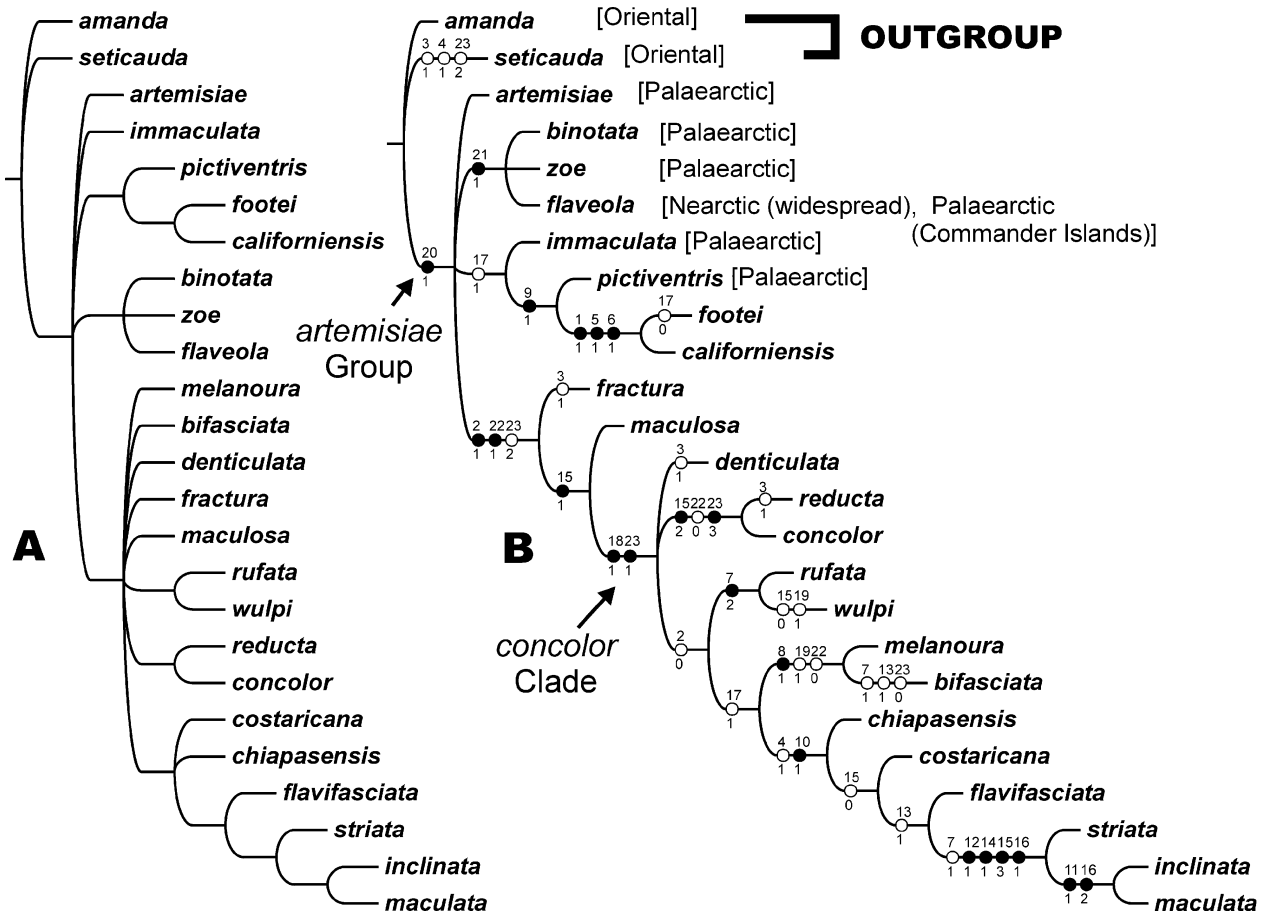

Fig. 1. Cladograms of New World *Trypeta* spp. using PAUP*. A, Strict consensus tree of twenty-three most parsimonious (MP) trees based on equally weighted characters (statistics for each MP tree: TL = 45; CI = 0.6444; HI = 0.3556; RI = 0.8025; RC = 0.5171); B, one of six MP trees found after successive weighting (same topology as the strict consensus tree). All character state changes are plotted using fast optimization (WINCLADA software). Solid circle, forward changes without homoplasy; hollow circle, changes with homoplasy.

restricted to the southwestern U.S.A. and Mesoamerica. It is relatively well supported by three synapomorphies in the weighted tree (Fig. 1B), although this hypothesis assumes there was reversal in all of these characters. Within this clade, another large subclade (*concolor* clade hereafter) including all of the species except *T. fractura* and *T. maculosa*, is recognized by the weighted analysis (Fig. 1B). The two synapomorphies (characters 18.1, 23.1) for the *concolor* clade are unique character states even within the *Trypeta* genus group, and thus clearly support this clade's monophyly, although the states for either character are unknown in several species and reversal in character 23 in *T. bifasciata* is assumed. There is little doubt about the relationships among *T. striata, T. inclinata* and *T. maculata*, the species with the most atypical wing patterns and venations (Fig. 6S–U), including several unique synapomorphies. If they did not share the synapomorphies of the *concolor* clade, we may not even have been able to correctly place them in the genus *Trypeta*. Their close relationship to *T. chiapasensis, T. flavifasciata* and *T. costaricana* is also supported by two synapomorphies in both analyses (characters 4.1, 10.1). The relationship of *T. reducta* and *T. concolor* is supported in both analyses by three synapomorphies, two of which are unambiguous. *Trypeta melanoura* and *T. bifasciata* appear to form a species pair based mainly on their usual lack of acrostichal setae (character 8.1). This loss has not been observed in any other *Trypeta*.

Biology and immature stages

The biology of *Trypeta* species is poorly known. Of the forty-six species world-wide, only eight have been reared. All of the species with known host plants are leaf miners in Asteraceae, as are species of the most closely related genera (Han, 1998, 1999). Only four of the New World species have been reared, although adults of two other species have been captured on plants that are likely to be their hosts (Table 3). Except for some hosts of *T. flaveola*, the host plants of the American species belong to the tribe Senecioneae.

Fig. 2. A, Mines of *Trypeta concolor* on the leaves of *Barkleyanthus salicifolius*; B, *T. concolor* larvae found together in a single mine.

Trypeta flaveola has been reared from fifteen Asteraceae species, mostly in California (see the Biology section for *T. flaveola* and Table 3), but only six of these plants are native, and further studies are needed to verify that all of them are natural field hosts. The presumed native hosts include an *Arnica* sp., two *Artemisia* spp., *Petasites* sp., and three *Senecio* spp.

Trypeta concolor has been reared from blotch mines on *Barkleyanthus salicifolius* (H.B.K.) H. Robins & Brett. The junior author also collected large numbers of adults of *T. reducta* on this plant at widely separated localities in Mexico (see the Type material section for *T. reducta*). These included pairs of flies in copulation and several females that were possibly ovipositing into leaves. *Barkleyanthus salicifolius* is thus also a likely host of *T. reducta*, but we have no rearings to confirm this relationship.

Senecio stoechadiformis DC is a host plant of *T. maculosa*, *Senecio serra* Hook is a host of *T. footei* (see the Material examined section for those species), and *Senecio cinerarioides* H. B. K., is probably a host of *T. denticulata* (not reared). The type series was collected on this plant, including a male and female in copulation. A leaf mine with a *Trypeta* larva, presumably of *T. denticulata*, was found on another close-by plant of *Senecio cinerarioides*.

Most available biological information for American *Trypeta* spp. pertains to *T. flaveola*, based on the study by Frick (1971a; as *T. angustigena*) in a laboratory garden in Albany, California. In addition to rating the preferences of this fly on the plants considered hosts (presumably based on the level of infestation), Frick also listed fourteen species of Asteraceae that were not attacked. He observed that *T. flaveola* was multivoltine, with probably five generations/year in central, coastal California. The life cycle averaged about 2 months, including 6–7 days for the egg, 6 ± 2 days for each of the larval instars, and 27 ± 4 days for the pupa. The preoviposition period averaged 7 days. Based on nine matings observed in cages, involving females from 4 to 49 days old and males from 3 to 27 days old, copulation lasted 3.75–7.5 h.

Frick (1971a) reported that *T. flaveola* females oviposit predominantly on the lower surfaces of horizontal leaves, with the eggs inserted under the epidermis. The larvae make relatively large mines and 'frequently hollow out small leaves, such as those of *Senecio serra*', but the second instars have 'the ability to exit from a leaf, crawl to another, bore into it, and continue mining'. The larvae leave their mines to pupariate in the soil. Adults were rarely observed, and the leaf mines are inconspicuous, usually on the lower half or two-thirds of the plant, often in mature leaves. The larvae of *T. concolor*, *T. footei*, and *T. maculosa* also leave their leaf mines to pupariate in the soil. The mines of *T. concolor* (Fig. 2A) are more conspicuous, usually occurring down the middle of the slender leaves of *Barkleyanthus salicifolius*. Multiple larvae were often found together in the same mine (Fig. 2B). Adults of *T. concolor* and *T. reducta* were relatively common (i.e. with multiple individuals on a single plant) on this common roadside shrub at various mid to high elevation sites in central Mexico visited by the junior author in August 1989 and September–October 1991. Pairs of *T. reducta* were observed in copulation on this plant, as was a pair of *T. denticulata* on *Senecio cinerarioides*.

The third instar larva and puparium known for four Nearctic *Trypeta* species are distinguished easily from

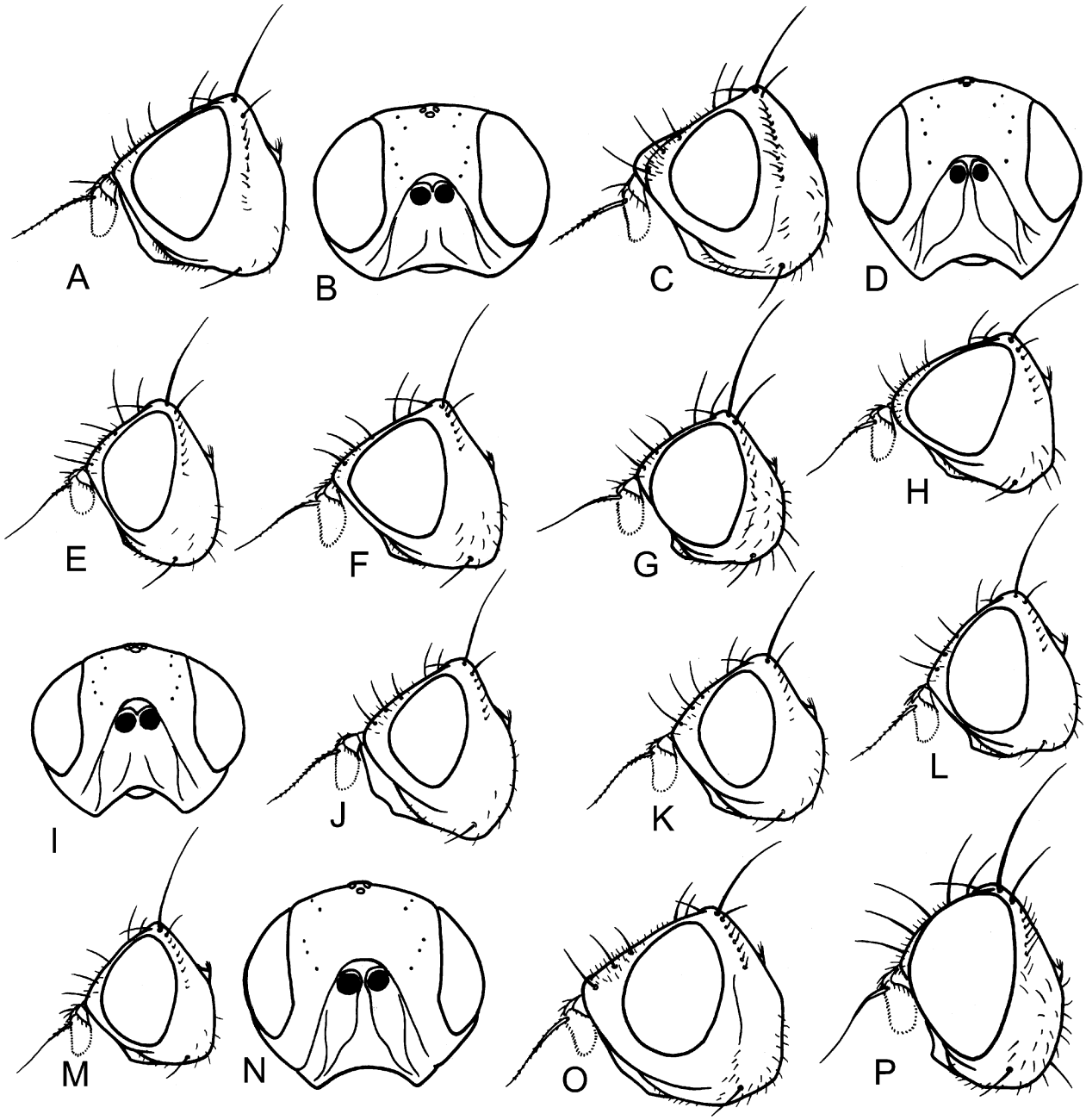

Fig. 3. Heads (B, D, I, N, anterior view; all others, lateral view). A, B, *Trypeta bifasciata*; C, D, *T. californiensis*; E, *T. chiapasensis*; F, *T. concolor*; G, *T. costaricana*; H, *T. denticulata*; I–L, *T. flaveola*; M, *T. flavifasciata*; N, O, *T. footei*; P, *T. inclinata*.

those of other New World genera of Tephritidae. Those of *T. concolor*, *T. denticulata* (tentatively identified), *T. flaveola* and *T. maculosa* have a nearly semicircular arrangement of the lobes of the anterior spiracle (eleven to sixteen lobes in *T. concolor*, seventeen to eighteen in *T. denticulata*, thirteen to twenty in *T. flaveola*, and thirteen to sixteen in *T. maculosa*), and the part of the peritreme bordering the middle opening of the posterior spiracle projects spinelike laterally. The puparia of these species are also a characteristic pale yellow colour. White (1988: fig. 220) indicated that the posterior spiracle is similar in some Palaearctic leaf-mining species, although the genus was not specified. *Acidia cognata* (Wiedemann), *T. artemisiae*, *T. concolor*, *T. flaveola*, *T. immaculata* and *Stemonocera cornuta* (Scopoli) also

Table 2. Character state distribution of characters used in the cladistic analysis of New World *Trypeta*. See the Appendix for an explanation of the character numbers. ? = uncertain state.

	Character number																						
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Outgroup																							
amanda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
seticauda	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Old World *Trypeta* (Ingroup)																							
pictiventris	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0
artemisiae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
binotata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
zoe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
immaculata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
New World *Trypeta* (Ingroup)																							
flaveola	0/1	0	0	0	0	0/1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
footei	1	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
californiensis	1	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0
fractura	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
maculosa	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	2
denticulata	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1/2	0	0	1	0	1	0	1	1
reducta	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0/1	1	0	1	0	0	3
concolor	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	1	0	0	3
rufata	0	0	0	0	0	0	2	0	0	0	0	0	0/1	0	1	0	0	1	0	1	0	?	1
wulpi	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1
melanoura	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	1	1	1	0	0	1
bifasciata	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	1	?	?	?	?	?	0
chiapasensis	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	1	1	0	1	0	1	?
costaricana	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	?	?	?	?	?	1
flavifasciata	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	1	1	0	1	0	1	?
striata	0	0	0	1	0	0	1	0	0	?	0	1	1	1	3	1	1	?	?	?	?	?	?
inclinata	0	0	0	1	0	0	1	0	0	1	1	1	1	1	3	2	1	?	?	?	?	?	1
maculata	0	0	0	1	0	0	1	0	0	1	1	1	1	1	3	2	1	1	0	1	0	1	1

have similar spinelike posterior spiracles (Han, 1999: fig. 11.2H). Specimens we examined of an undetermined species of *Strauzia*, *Euleia fratria* (Loew) and *Euleia uncinata* (Coquillett) have the puparium similar in colour, but the posterior spiracle is normal. The anterior spiracle is similar to *Trypeta* in the *Euleia* species, but in the *Strauzia* species the lobes are in several rows which are much less curved.

Genus *Trypeta* Meigen

Trypeta Meigen, 1803: 277 (type species, *Musca artemisiae* Fabricius, by subsequent designation of Coquillett, 1910: 618) – Rondani, 1870: 7 (invalid designation of *Musca arctii* De Geer as type species, not an originally included species) – Foote *et al*., 1993: 55, 448 (see this reference for more complete nomenclatural history of *Trypeta*).
Forellia Robineau-Desvoidy, 1830: 760 (type species, *Forellia onopordi* Robineau-Desvoidy (= *artemisiae* Fabricius), by subsequent designation of Duponchel 1845: 676).
Spilographa Loew, 1862: 39 (type species, *Trypeta hamifera* Loew (= *immaculata* Macquart), by subsequent designation of Coquillett, 1910: 607).
Heliotrypeta Richter & Kandybina, 1985: 23 (type species, *Trypeta dorsocentralis* Richter and Kandybina, by original designation, proposed as a subgenus).

Diagnosis. The following combination of characters separates *Trypeta* from the other genera of the tribe Trypetini, and also from most other tephritid genera: (1) body predominantly yellow brown with no or few outstanding dark markings on head and thorax (*T. reducta* occasionally with first flagellomere dark brown and/or with dark brown dorsocentral vittae on scutum; *T. reducta* rarely, *T. costaricana* often with brown marks on mediotergite, and *T. melanoura* always with entirely brown mediotergite); (2) usually 3 pairs of evenly spaced frontal setae without sexual dimorphism (additional seta(e) may occasionally be found on one side or, more rarely, on both sides; such additional setae are most frequently found in *T. melanoura* and *T. footei*); (3) 2 pairs of reclinate orbital setae; (4) flagellomere 1 rounded apically; (5) dorsocentral seta slightly anterior to level of postsutural supra-alar seta to midway from it to level of intra-alar seta; (6) 2 pairs of scutellar setae, with apical pair cruciate; (7) anepisternum with single strong seta and sometimes 1 reduced hairlike seta ventral to it; (8) katepisternal

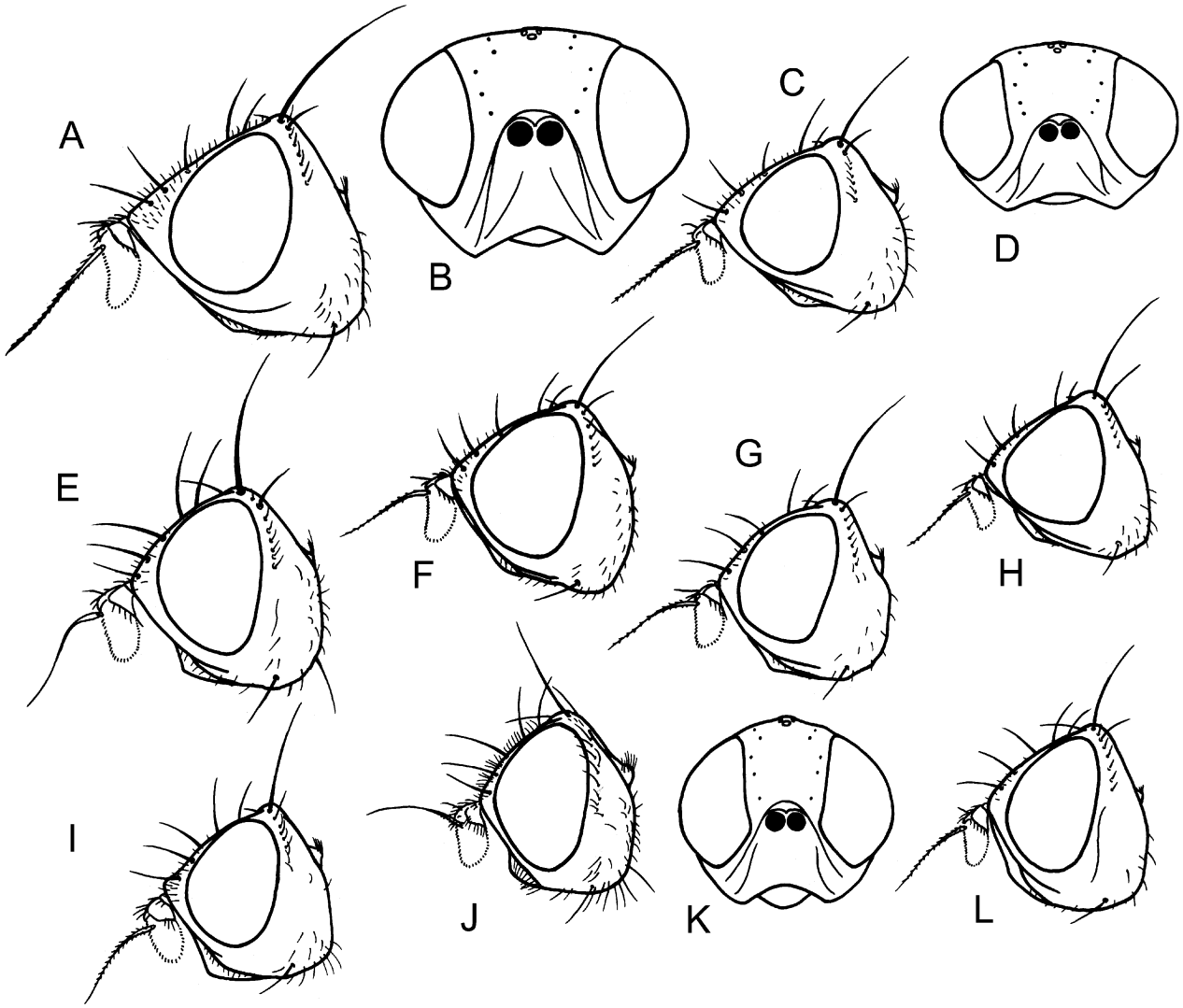

Fig. 4. Heads (B, D, K, anterior view; all others, lateral view). A–D, *Trypeta fractura*; E, *T. maculata*; F, *T. maculosa*; G, *T. melanoura*; H, *T. reducta*; I, *T. rufata*; J, *T. striata*; K, L, *T. wulpi*.

seta present; (9) pterostigma distinctly shorter than cell c measured along vein C; and (10) crossvein R-M frequently at or near midlength of cell dm.

For a more confident identification of *Trypeta* species, it is better to recognize them first as members of the *Trypeta* group (*sensu* Han, 1999) and then eliminate the other genera using the above external characters. Recognition of the *Trypeta* group involves examining the following genitalic structures: (1) medial sclerite of glans with internal sculpture pattern of round granulation (Figs 10, 11); (2) dorsal sclerite of glans (= lateral flap of acrophallus) with internal sculpture pattern of elongated granulation (Figs 10, 11); (3) lateral prensiseta much smaller than medial prensiseta or absent (Figs 8, 9); and (4) aculeus broad, tip almost entirely finely serrate laterally except sometimes extreme apex (Figs 13, 14). In a few species, either (1) or (2) may be secondarily reduced.

Description of North American Trypeta. Body predominantly yellow brown to orange brown with dark brown setae and yellow brown to dark brown setulae, often with tiny dark spots, especially on scutellum; wing length 4–6.5 mm; thorax length 1.5–2.4 mm. Head yellow brown to orange brown with brown to dark brown ocellar tubercle; frons–head ratio 0.37–0.55, eye ratio 0.7–0.9, gena–eye ratio 0.1–0.5; ocellar seta 0.5–2.6× as long as ocellar tubercle; 2 orbital, 3 frontal, 1 medial vertical, 1 lateral vertical, 1 postocellar, 1 paravertical setae; supracervical setae yellow brown; scape and pedicel with short yellow brown to dark brown setulae; first flagellomere 1.5–2.8×

Table 3. Confirmed and presumed host plants of New World *Trypeta* species. An asterisk indicates records not confirmed by specimens we examined. Relationships based on observations of adult behaviour need to be confirmed by rearing.

Host tribe	Host species	*Trypeta* species	Record basis	Origin	References
Anthemideae	*Artemisia douglasiana* Bess.	*flaveola*	Garden reared	Native	Frick (1971a)
	Artemisia suksdorfii Piper	*flaveola*	Field reared?	Native	Foote (1960)
	Chrysanthemum × *morifolium*	*flaveola*	Field reared	Exotic	Frick & Hawkes (1970) Ramat.
Cynareae	*Cynara scolymus* L.	*flaveola**	Garden reared	Exotic	Frick (1971a)
Helenieae	*Arnica alpina* (L.) Olin	*flaveola*	Garden reared	Exotic	Frick (1971a)
	A. chamissonis Less. ssp. *foliosa* (Nutt.) Maguire	*flaveola*	Garden reared	Native	Frick (1971a)
	A. montana L.	*flaveola*	Garden reared	Exotic	Frick (1971a)
Senecioneae	*Barkleyanthus salicifolius* (H.B.K.) H. Robins & Brett	*concolor*	Field reared	Native	New data
		reducta	Adult behaviour		New data
	Cacalia suaveolens L.	*flaveola**	Garden reared	Exotic	Frick (1971a)
	Delairea odourata Lem.	*flaveola*	Field reared?	Exotic	Foote (1960), Frick (1971b)
	Petasites palmatus (Ait.) Gray	*flaveola*	Garden reared	Native	Frick (1971a)
	Senecio aureus L.	*flaveola*	Field reared	Native	Sutton *et al.* (2003)
	S. cinerarioides H.B.K.	*denticulata*	Adult behaviour	Native	New data
	S. jacobaea L.	*flaveola*	Field reared	Exotic	Frick & Hawkes (1970)
	S. paludosus L.	*flaveola*	Garden reared	Exotic	Frick (1971a)
	S. serra Hook	*flaveola*	Garden reared	Native	Frick (1971a)
		footei	Field reared	Native	New data (E. A. Lisowski)
	S. stoechadiformis DC.	*maculosa*	Field reared	Native	New data
	S. triangularis Hook	*flaveola*	Garden reared	Native	Frick (1971a)

pedicel length, apically rounded; arista entirely short pubescent or bare except basally; parafacial 0.3–1.5× first flagellomere width; genal seta strong, yellow brown to dark brown; postgena moderately swollen with long pale yellow to brown setulae. Thorax yellow brown to orange brown with scutum shiny to subshiny; 1 postpronotal, 2 scapular, 1 acrostichal (missing in most *T. melanoura* and *T. bifasciata*), 1 dorsocentral, 1 intra-alar, 1 presutural supra-alar (missing in *T. bifasciata*), 1 postsutural supra-alar, 1 postalar and 2 notopleural setae; dorsocentral seta slightly anterior to level of postsutural supra-alar seta to midway from it to level of intra-alar seta; scutellum slightly convex, almost bare with few short marginal setulae; basal scutellar setae 2–3× scutellum length, except in *T. footei* and *T. californiensis* slightly longer than scutellum; apical scutellar setae cruciate, slightly shorter than basal scutellar setae; proepisternum covered with relatively long yellow brown to dark brown setulae; anepisternum with 1 strong seta and sometimes 1 reduced hairlike seta ventral to it; katepisternum with 1 strong seta, ventrally with pile of long yellow brown to dark brown setulae; mediotergite shiny yellow brown except in *T. melanoura* (shiny dark brown) and some *T. costaricana* and *reducta* (with brown marks); legs yellow to orange brown, with single midtibial spur; fore femur slightly

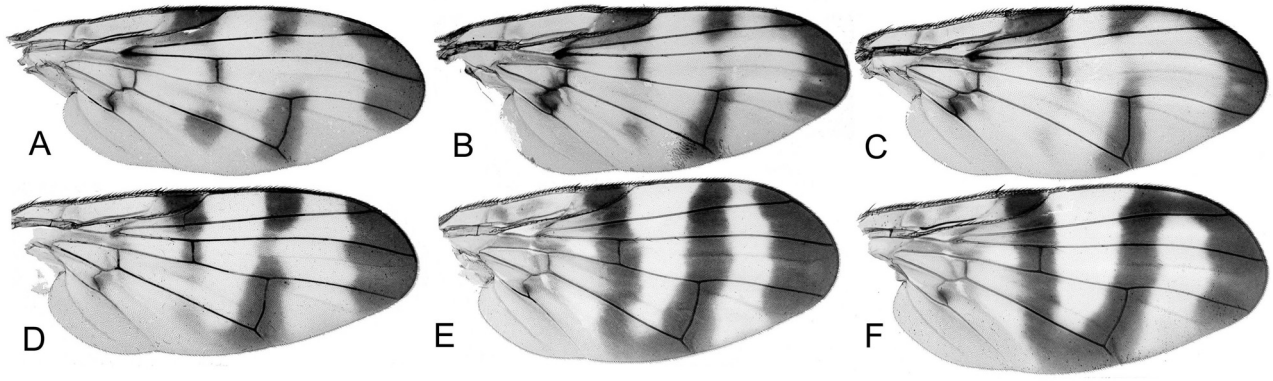

Fig. 5. Wing variation of *Trypeta flaveola* from various localities; A, Spokane Co., WS; B, Alameda Co., CA; C, Alameda Co., CA; D, Beaver Co., PA; E, River Forest, IL; F, Fayette Co., PA.

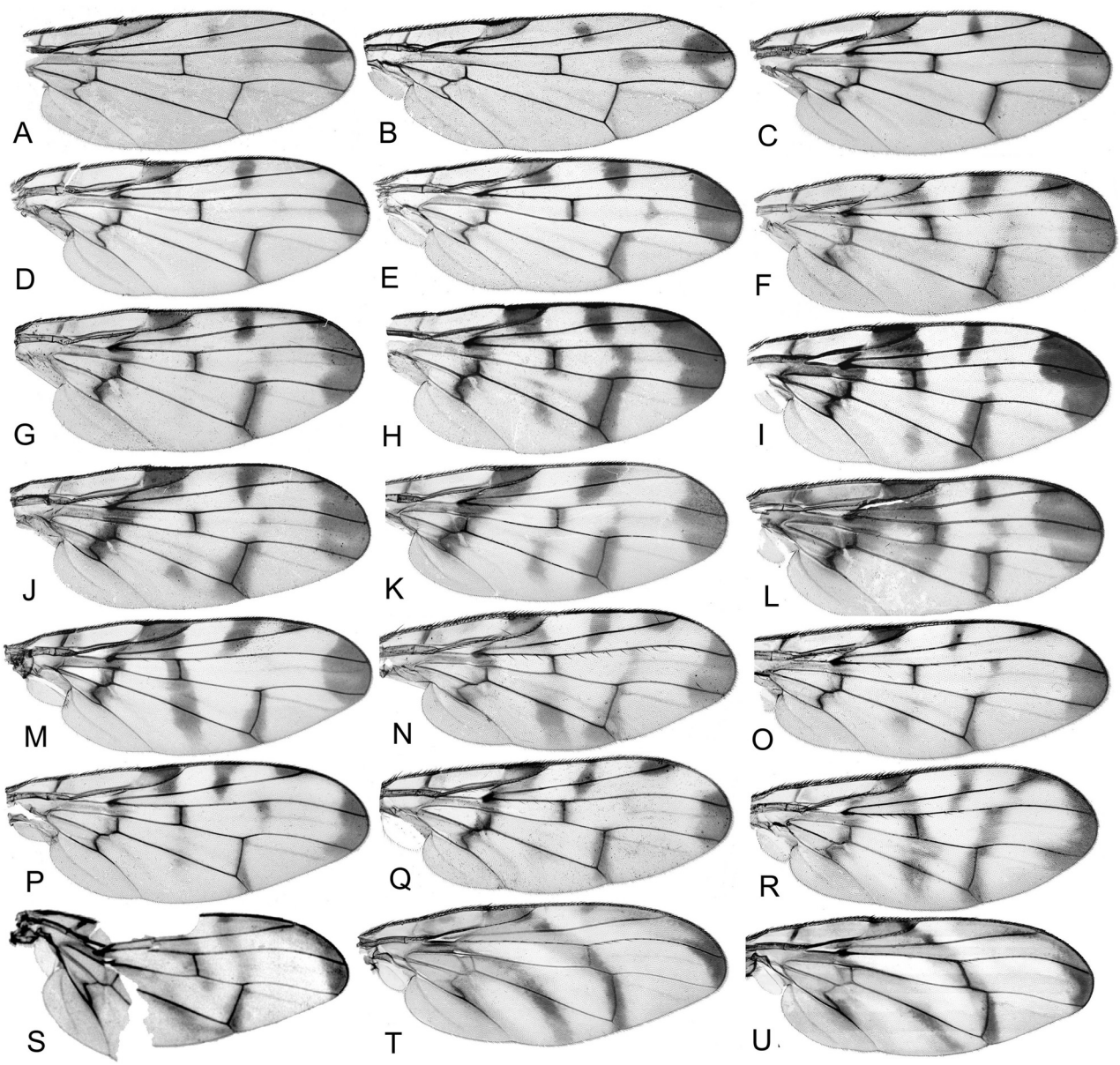

Fig. 6. Wings. A, B, *Trypeta reducta*; C, *T. denticulata*; D, E, *T. concolor*; F, *T. flavifasciata*; G, H, *T. footei*; I, *T. costaricana*; J, K, *T. fractura*; L, *T. californiensis*; M, *T. maculosa*; N, *T. chiapasensis*; O, *T. rufata*; P, *T. melanoura*; Q, *T. bifasciata*; R, *T. wulpi*; S, *T. striata*; T, *T. inclinata*; U, *T. maculata*.

swollen, with 5–7 posteroventral setae. Wing hyaline with pattern of pale yellow to dark brown bands or spots; pattern highly variable interspecifically and, especially in *T. flaveola*, intraspecifically (Fig. 5); vein R_{4+5} ratio 1.1–3.1; vein M ratio 0.12–1.48; subcosta–costa ratio 0.4–0.72; extension of cell bcu 1–2× as long as basal width; halter pale yellow. Abdomen yellow brown to orange brown with brown to dark brown setae and setulae; preabdominal tergites, in some species, with dark brown lateral spots or bands sometimes connecting or almost connecting medially. Male genitalia with hypandrium narrow, apically flattened; arm of phallapodeme connected to lateral sclerite; lateral surstylus relatively long with apex either truncate or pointed in profile; ejaculatory apodeme broad, fan-shaped; medial surstylus with lateral prensiseta much shorter than medial prensiseta, or absent; medial sclerite of glans with internal sculpture pattern of round granulation; dorsal sclerite of glans mostly with internal sculpture pattern of elongated granulation; subapical lobe of glans reduced. Female postabdomen with oviscape often with various dorsal and ventral marginal setae; eversible membrane medially with strong triangular denticles and posteriorly with smaller denticles; dorsal and ventral taeniae extended at most

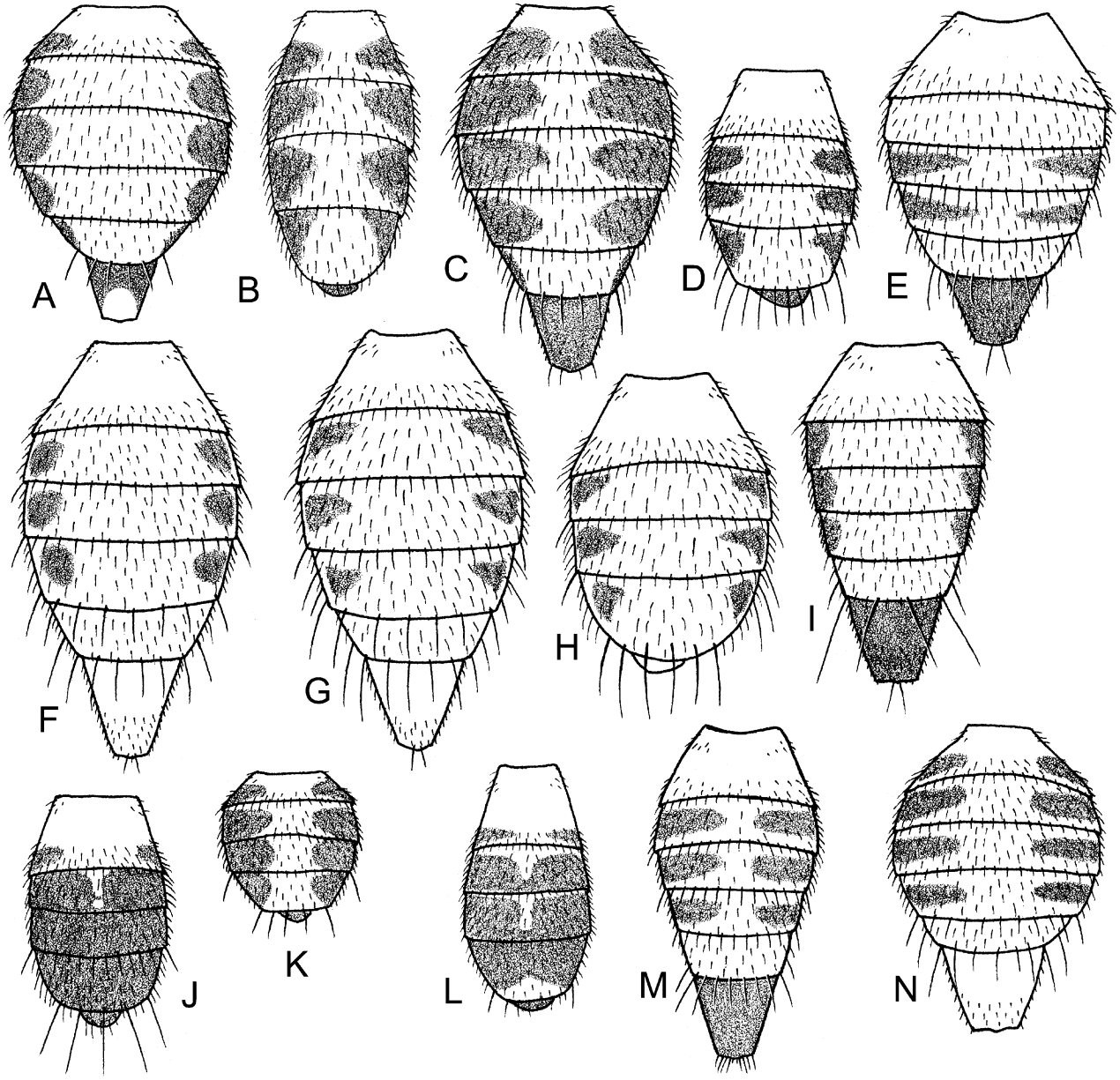

Fig. 7. Abdomen, dorsal view. A, *Trypeta bifasciata*, female; B, *T. californiensis*, male; C, same, female; D, *T. chiapasensis*, male; E, *T. costaricana*, female; F, *T. inclinata*, female; G, *T. maculata*, female; H, same, male; I, *T. melanoura*, female; J, same, male; K, *T. flavifasciata*, male; L, *T. reducta*, male; M, same, female; N, *T. striata*, female.

to midlength of membrane; aculeus broad, dorsoventrally flattened; tip almost entirely finely serrate laterally except sometimes extreme apex; dorsomedially with small projection with pair of 2 more or less parallel ridges extending toward apex; 3 spermathecae with transverse spinular papillae, 1 spermatheca always much smaller than other 2; apical portion of spermathecal duct, less than length of spermatheca, swollen. Eggs narrowly elliptic in outline with tiny knoblike micropylar end.

Distribution. The New World species of *Trypeta* are found north from Alaska and the Northwest Territories south to Costa Rica. The northernmost species, *T. flaveola*, is by far the most widespread and is the only species known from eastern North America. Its distribution extends to the Commander Islands (Beringa and Mednyy Islands) in Kamchatskaya, Russia (Richter & Kandybina, 1985) and across southern Canada and the northern U.S.A., extending southwards at higher elevations. Most species known

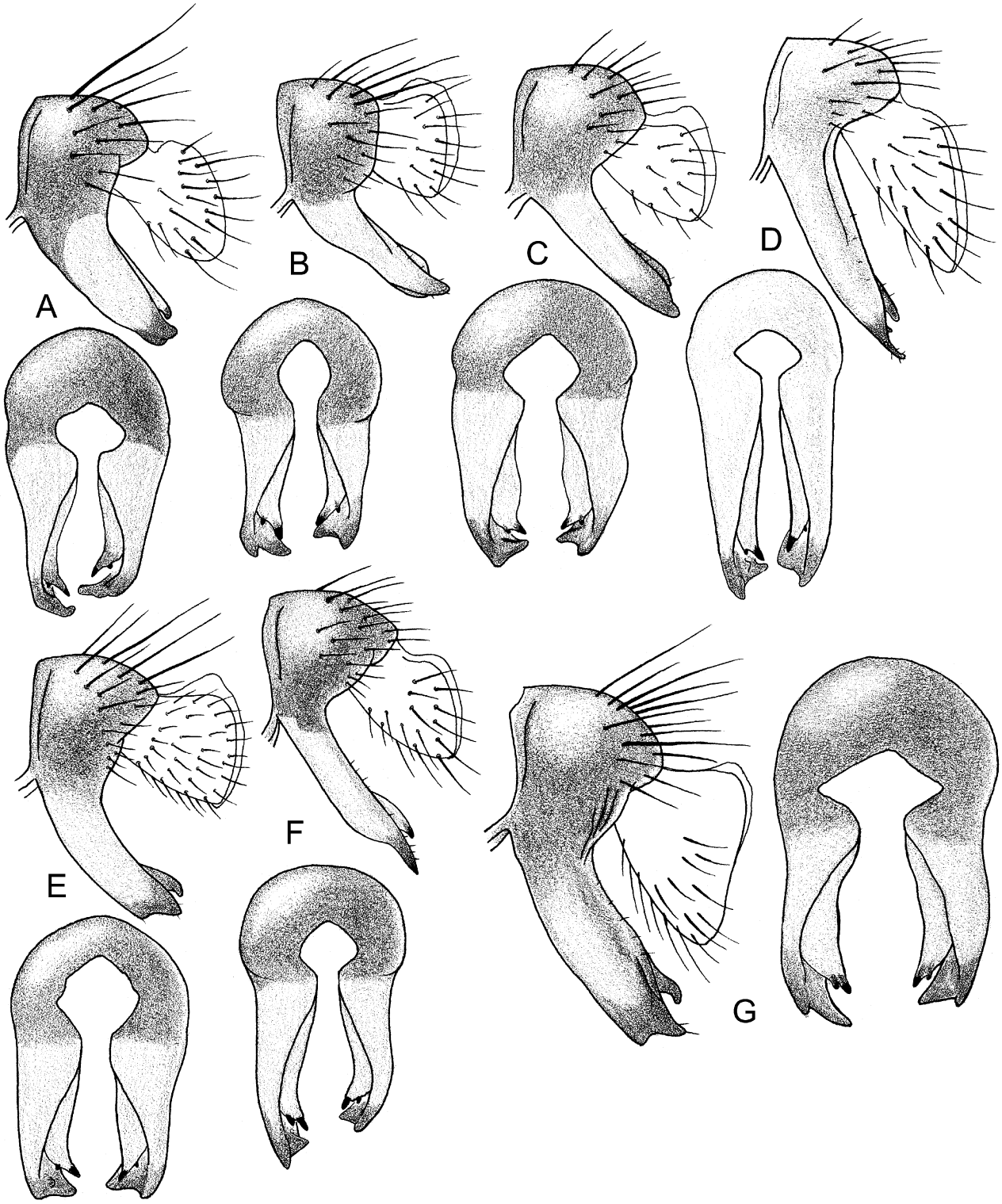

Fig. 8. Epandrium, surstyli, and proctiger, lateral view (upper) and posterior view (lower, proctiger removed). A, *Trypeta californiensis*; B, *T. chiapasensis*; C, *T. concolor*; D, *T. denticulata*; E, *T. flaveola*; F, *T. flavifasciata*; G, *T. fractura.*

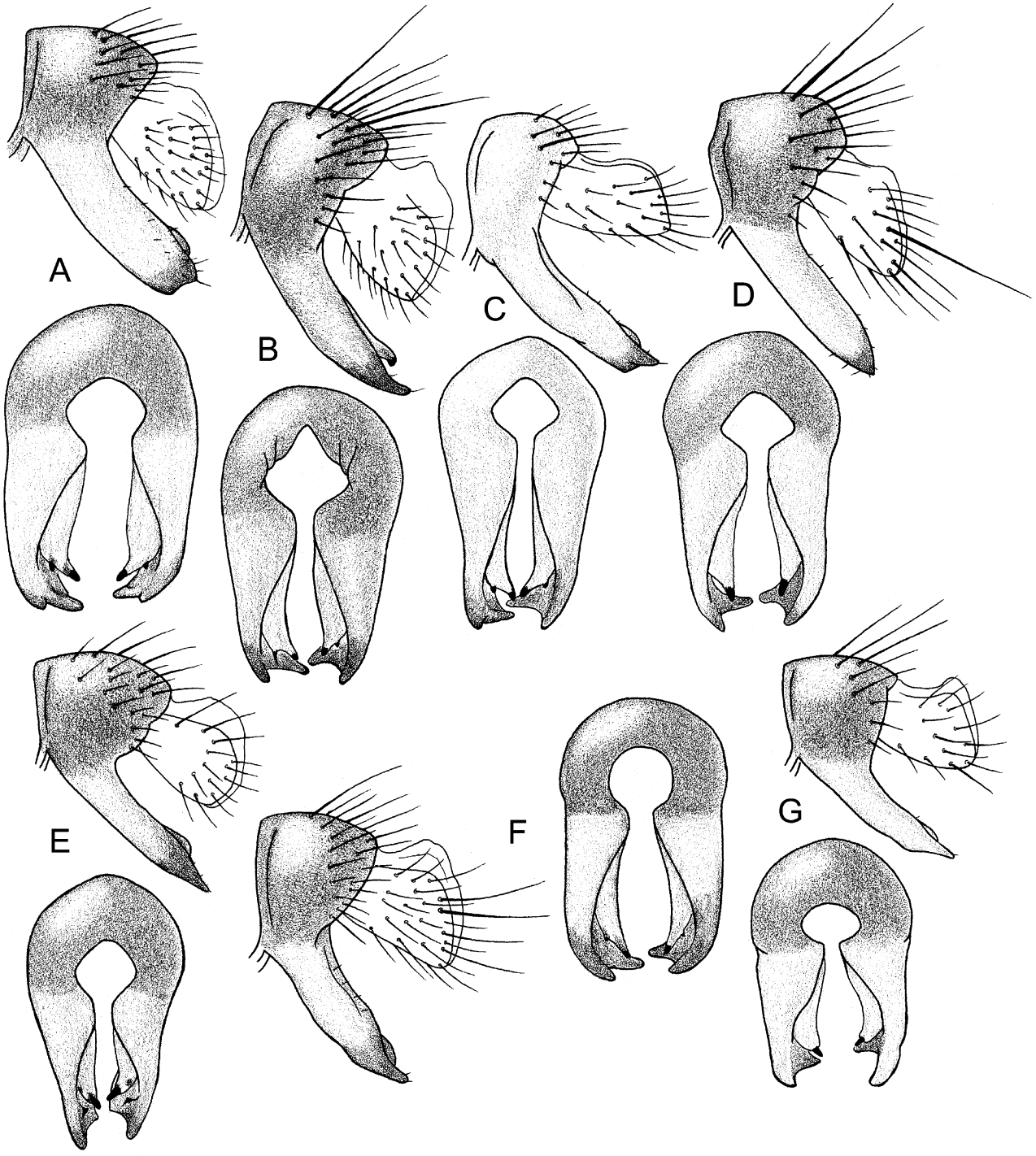

Fig. 9. Epandrium, surstyli, and proctiger, lateral view (upper) and posterior view (lower, proctiger removed). A, *Trypeta footei*; B, *T. maculata*; C, *T. maculosa*; D, *T. melanoura*; E, *T. reducta*; F, *T. rufata*; G, *T. wulpi*.

from Mexico and Costa Rica are reported thus far from relatively small ranges in highland, temperate areas, although *T. maculosa* and *T. fractura* range from the western U.S.A. to central Mexico.

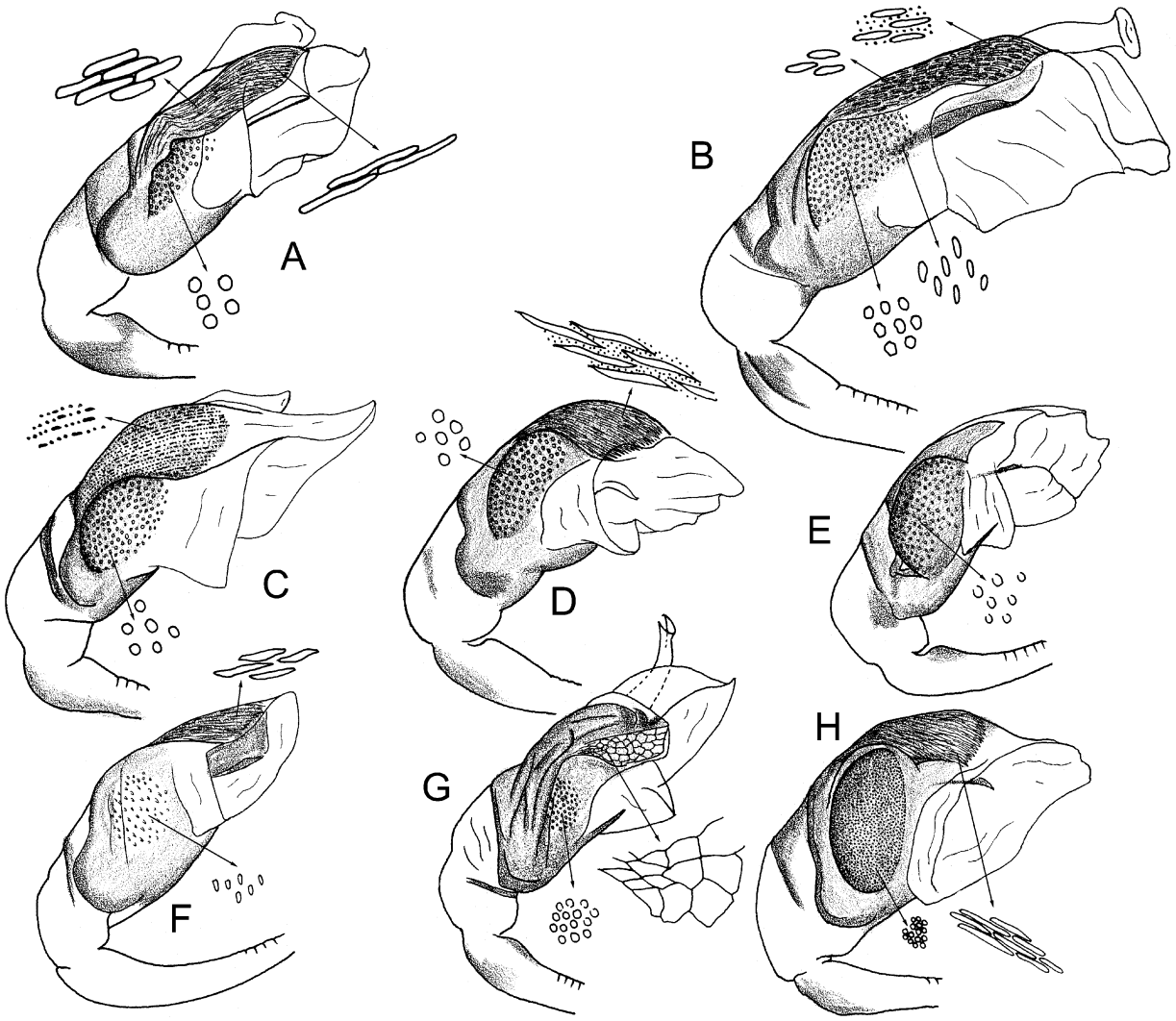

Fig. 10. Glans, dorsolateral view. A, *Trypeta amanda*; B, *T. seticauda*; C, *T. artemisiae*; D, *T. californiensis*; E, *T. chiapasensis*; F, *T. concolor*; G, *T. denticulata*; H, *T. flaveola*.

Key to the New World species of *Trypeta* Meigen

1. Wing pattern reduced, at most with brown apical spot and the following usually faint yellow brown marks: spot in middle of cell r_{4+5}, spot in r_1 and/or r_{2+3} not reaching costa, and usually narrow, weak infuscation along R-M and DM-Cu; pterostigma sometimes yellow, but without brown markings (Fig. 6A, B)... *reducta*, **sp.n.**
– Wing pattern with more extensive or darker markings, at least with distinct brown marks along BM-Cu and Cu_2, R-M, and DM-Cu, in pterostigma, and in cell r_1 reaching costa 2
2. Mediotergite entirely dark brown ..... *melanoura*, **sp.n.**
– Mediotergite mostly to entirely yellow to orange brown, concolorous with nearby areas, at most with lateral brown marks (some *T. costaricana*) 3
3. Wing with oblique band from crossvein BM-Cu across base of cell dm to posterior margin in distal half of cell cu_1 (Fig. 6S–U); subapical band (covering DM-Cu) uninterrupted, anterior part basally curved; apical extension of cell bcu at least 2× as long as basal width 4
– Wing without such oblique band; subapical band often interrupted, anterior part usually not basally curved; apical extension of cell bcu at most 1.5× as long as basal width 6
4. Crossvein R-M situated approximately at apical two-thirds of cell dm (Fig. 6S); R-M and DM-Cu covered by two separate bands ..... *striata* (Wulp)
– Crossvein R-M situated beyond apical four-fifths of cell dm (Fig. 6T, U); R-M and DM-Cu covered by single band .. 5
5. Oblique band crossing cell cu_1 ending midway between apices of $A_1 + Cu_2$ and Cu_1 (Fig. 6T)..... *inclinata*, **sp.n.**

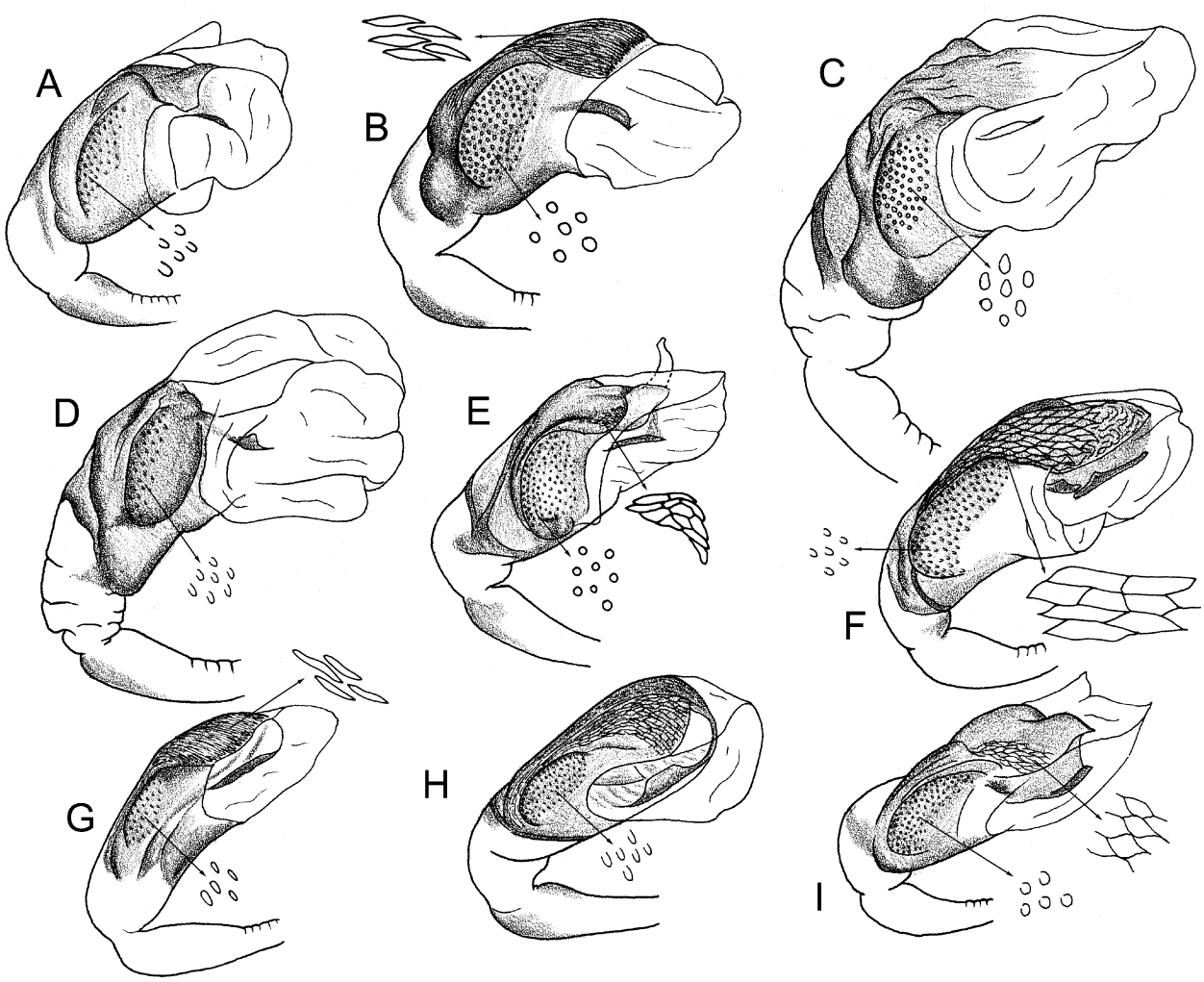

Fig. 11. Glans, dorsolateral view. A, *Trypeta flavifasciata*; B, *T. footei*; C, *T. fractura*; D, *T. maculata*; E, *T. maculosa*; F, *T. melanoura*; G, *T. reducta*; H, *T. rufata*; I, *T. wulpi.*

– Oblique band crossing cell cu_1 ending distinctly closer to Cu_1 (Fig. 6U) ..... *maculata*, **sp.n.**

6. Facial carina with angular margins, dorsal part strong and slender (Fig. 3D, N); basal scutellar setae at most 1.5× scutellum length; parafacial usually at least as wide as flagellomere 1 (Fig. 3C, O) 7
– Facial carina with rounded margins, moderately broad dorsally (Figs 3B, 4B, D, K); basal scutellar setae at least 2× scutellum length; parafacial usually narrower than flagellomere 1 width 8

7. Abdominal tergites 2–5 each with dark brown lateral bands (Fig. 7B, C); spot on crossvein H brown; discal band uninterrupted (Fig. 6L) ..... *californiensis*, **sp.n.**
– Abdominal tergites entirely yellow brown to orange brown; spot on crossvein H pale yellow brown; discal band often interrupted (Fig. 6G, H) ..... *footei*, **sp.n.**

8. Arista bare except for basal area; vein R_{4+5} distal to crossvein R-M with more than ten tiny setulae 9
– Arista short pubescent along whole length (clearly visible under 50× magnification); vein R_{4+5} distal to crossvein R-M with less than eight tiny setulae 11

9. Abdominal syntergite 1 + 2 and tergite 3 each with large, strong, dark brown lateral bands (Fig. 7K) ..... *flavifasciata*, **sp.n.**
– Abdominal syntergite 1 + 2 yellow brown without dark bands, tergite 3 with or without dark brown lateral spot or band (Fig. 7D, E); vein R_{4+5} with relatively long setulae 10

10. Apex of cell r_{2+3} with marginal hyaline area (Fig. 6N); abdominal tergites 3–5 each with similar sized lateral band (Fig. 7D) ..... *chiapasensis*, **sp.n.**

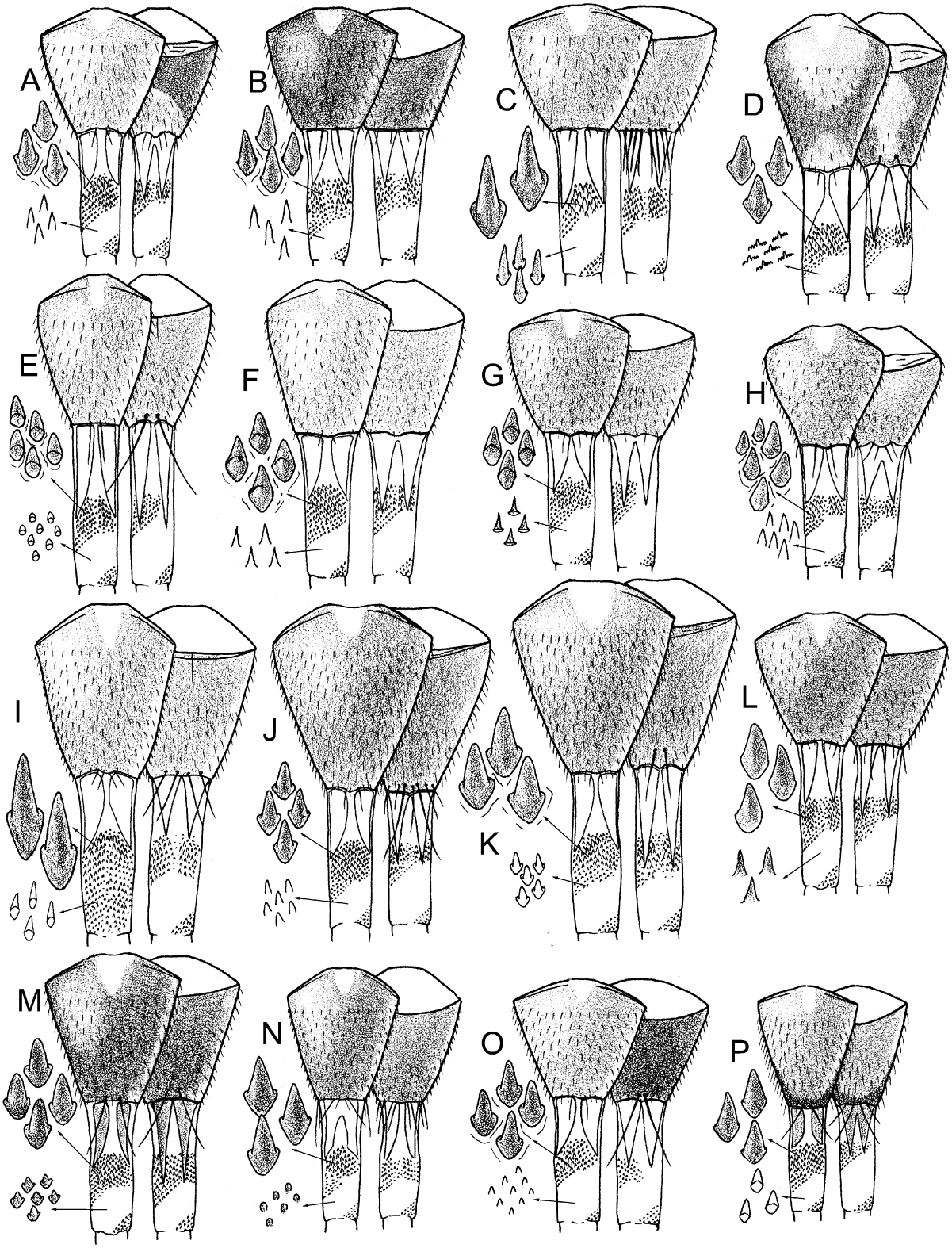

Fig. 12. Female postabdomen, ventral and dorsal views (insets at 8× main figures). A, *Trypeta bifasciata*; B, *T. californiensis*; C, *T. concolor*; D, *T. costaricana*; E, *T. denticulata*; F, G, *T. flaveola*; H, *T. footei*; I, *T. fractura*; J, *T. inclinata*; K, *T. maculata*; L, *T. maculosa*; M, *T. melanoura*; N, *T. reducta*; O, *T. rufata*; P, *T. wulpi*.

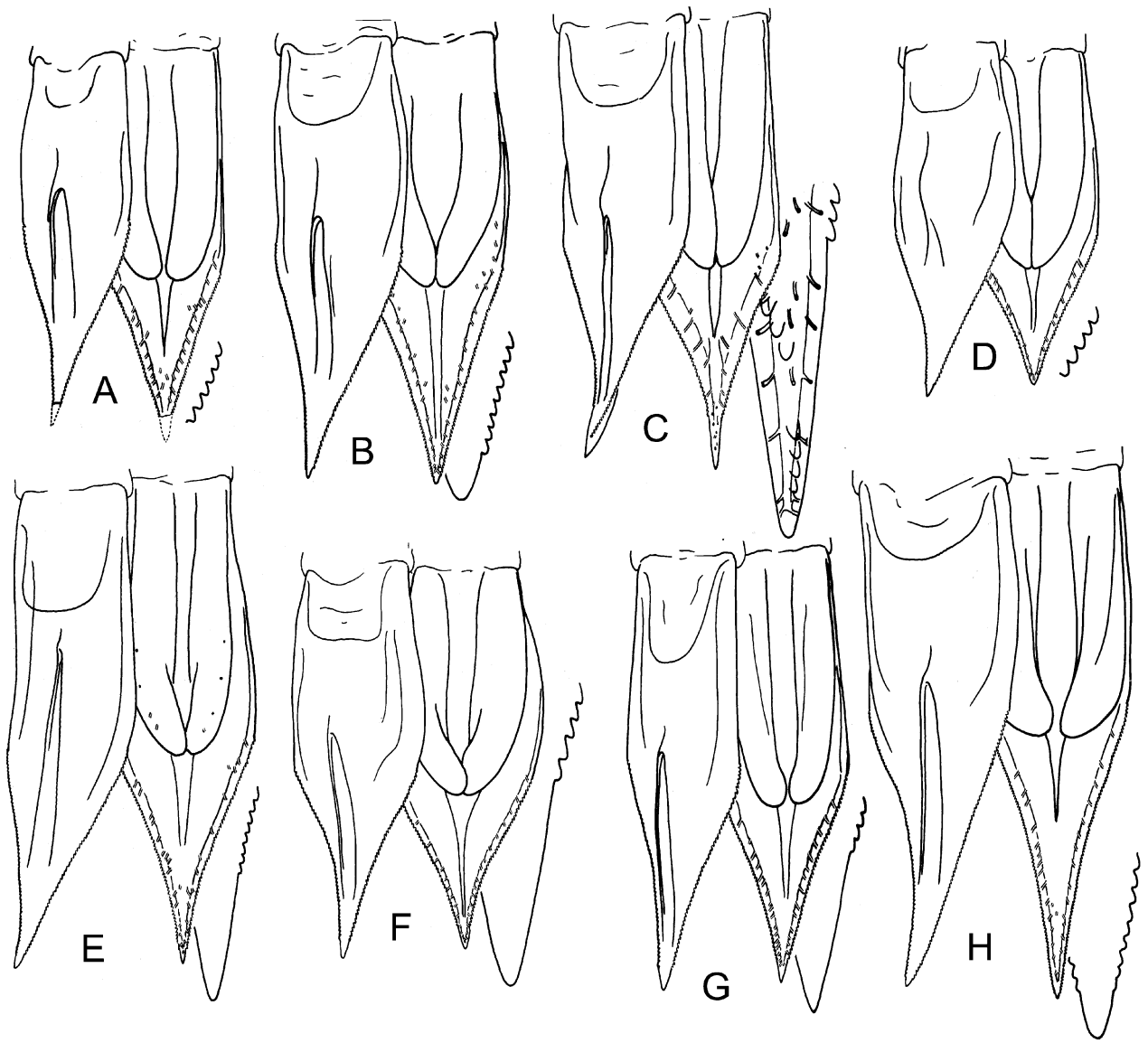

Fig. 13. Aculeus, dorsolateral and ventral views. A, *Trypeta bifasciata*; B, *T. californiensis*; C, *T. concolor*; D, *T. costaricana*; E, *T. denticulata*; F, *T. flaveola*; G, *T. footei*; H, *T. fractura.*

– Apex of cell r_{2+3} entirely dark brown (Fig. 6I); abdominal tergite 3 entirely yellow or with lateral brown spot or band smaller than those on tergites 4–5 (Fig. 7E) ..... *costaricana*, **sp.n.**

11. Apex of vein R_{2+3} bordered by distinct isolated brown spot not connected to spot on apex of wing (Fig. 6M, O, Q)..... 12
– Apex of vein R_{2+3} bordered by hyaline areas (Fig. 6D, K) or by dark band extending to apex of wing (Figs 5, 6E, J, R)..... 15

12. Acrostichal and presutural supra-alar setae absent; abdominal tergites 2–5 each with dark brown lateral bands (Fig. 7A) ..... *bifasciata*, **sp.n.**
– Acrostichal and presutural supra-alar setae present; abdominal tergites entirely yellow brown to orange brown ... 13

13. Wing with dark unbroken discal band from pterostigma across R-M to distal half of cell cu_1 (Fig. 6M); R-M proximal to midlength of cell dm, vein M ratio 1.3–1.5 ..... *maculosa* (Coquillett)
– Discal band broken by hyaline or distinctly paler area (Fig. 6C, O); R-M at or slightly distal to midlength of cell dm, vein M ratio 0.79–1.01 14

14. In profile, face meeting frons at angle of 90° or less, face receding (Fig. 3H)..... *denticulata*, **sp.n.** (in part)
– In profile, face meeting frons at angle distinctly greater than 90°, face not so strongly receding (Fig. 4I) ... *rufata* (Wulp)

15. In profile, face meeting frons at angle of 90° or less, face receding (Figs 3F, H, 4A, C) 16
– In profile, face meeting frons at angle distinctly greater than 90°, face not so strongly receding (Figs 3J–L, 4L) 18
16. Dorsocentral setae distinctly posterior to level of postsutural supra-alar setae; dark spot usually present on or posterior to vein Cu_1 at apical three-fifths of cell dm (Fig. 6J, K); apical wing band usually extended into cell r_1 ..... *fractura* (Coquillett)
– Dorsocentral setae aligned with postsutural supra-alar setae; vein Cu_1 without such dark spot (Fig. 6C–E); apical wing band usually well separated from apex of R_{2+3}, never extended into r_1 17
17. Vein R-M situated at or near middle of cell dm, M ratio 0.87–1.01 (Fig. 6C); ocellar setae reduced to tiny hairs shorter than ocellar tubercle; extreme apex of aculeus without fine serration (Fig. 13E) ..... *denticulata*, **sp.n.** (in part)
– Vein R-M situated clearly apicad of middle of cell dm, M ratio 0.58–0.75 (Fig. 6D, E); ocellar seta usually longer than ocellar tubercle, sometimes shorter in male; extreme apex of aculeus with fine serrations fused into single medial dorsal row (Fig. 13C) ..... *concolor* (Wulp)
18. Wing bands yellow brown, rather slender (Fig. 6R); accessory costal band clearly recognizable between discal band and strongly oblique subapical band ... *wulpi*, **sp.n.**
– Wing bands brown to dark brown, usually broad (Fig. 5); no accessory costal band present between discal band and more or less perpendicular subapical band, although subapical band sometimes broken (if isolated spot present in cell r_1 (Fig. 5A–C), aligned with marking on crossvein DM-Cu) ..... *flaveola* Coquillett

1. *Trypeta bifasciata*, sp.n. (Figs 3A, B, 6Q, 7A, 12A, 13A, 15A, 17D)

Diagnosis. Differs from all known *Trypeta* species by the lack of both acrostichal and presutural supra-alar setae. The acrostichal seta is usually absent in *T. melanoura* which differs from *T. bifasciata* in possessing a presutural supra-alar seta and the mediotergite being dark brown.

Description. Body mostly shiny to subshiny yellow brown, with dark brown lateral marks on abdominal tergites; setae and setulae dark brown. Head (Fig. 3A, B) with frontofacial angle 105°; medial vertical seta 0.7× longest diameter of eye; lateral vertical seta 0.6× as long as medial vertical seta; postocellar seta 0.4× as long as medial vertical seta; paravertical seta 0.6× as long as postocellar seta; ocellar seta hairlike, about as long as ocellar tubercle; arista entirely short pubescent; facial carina with rounded margins, dorsal part moderately broad; parafacial 0.4× as wide as flagellomere 1; genal seta strong, dark brown; postocular setae extended 0.7× distance from dorsal eye margin to ventral eye margin. Thorax entirely yellow to orange brown with dark brown setae and setulae; scutum shiny orange brown with dense, relatively long setulae, nonmicrotrichose except narrow anterior, lateral and posterior margins; dorsocentral seta about 0.3× distance from level of postsutural supra-alar seta to intra-alar seta; acrostichal and presutural supra-alar setae absent; scutellum with basal seta 2.2× as long as scutellum and apical seta 1.8× as long as scutellum; proepisternum densely covered with yellow brown setulae; anepisternum with 1 outstanding seta; mediotergite shiny yellow brown. Wing (Fig. 6Q) hyaline with dark brown pattern, including: yellow spot bordering crossvein H and in cell br posterior to it; narrow brown subcostal band from fork of Rs to Cu_2, connected to brown spot on pterostigma; brown spot covering all of pterostigma and area posterior to it in cells r_1 and r_{2+3}, paler in latter 2 cells, separated from spot on R-M; brown spot on R-M; narrow, oblique brown band in middle of cells r_1 and r_{2+3}, reaching costa and vein R_{4+5}, almost connected to spot on R-M; brown subapical band covering DM-Cu, extending to wing margin along Cu_1; small, faint spot in middle of cell r_{4+5}, aligned between anterior end of DM-Cu and apex of vein R_{2+3}; brown spot at apex of cell r_1, extending slightly into cell r_{2+3}; dark brown apical spot, well separated from spot on apex of R_{2+3}, moderately broad, with proximal margin concave in cell r_{4+5}. No spot in cell cu_1 posterior to R-M; R_{4+5} with 7 tiny setulae between node and R-M, and with 3 setulae apical to R-M; cell bm mostly nonmicrotrichose except apical fourth; cell r_1 basal to fork of Rs and alula also mostly bare. Female abdomen shiny yellow brown with large dark brown lateral spots on syntergite 1 + 2 and tergites 3–6 (Fig. 7A); oviscape ventrally yellow brown and dorsally dark brown except semicircular yellow brown area on posterior half, with 1 pair of small ventral marginal setae, no outstanding dorsal marginal setae (Fig. 12A); eversible membrane with taeniae about 0.5× as long as total length of membrane; aculeus broad, more or less parallel-sided with apical two-fifths tapered (Fig. 13A); tip with fine lateral serrations; spermathecae yellow brown, round with sparse transverse spinular papillae (Fig. 15A). Male unknown.

Material examined. Holotype, ♀, MEXICO: Durango: El Salto, 3 mi. E, 8200 ft, 18.vii.1964 (J. F. McAlpine) (CNC USNM00216048).

Distribution. Known only from the type locality in the Sierra Madre Occidental in northern Mexico (Durango) (Fig. 16D).

Etymology. The specific epithet is an adjective derived from the Latin 'bi', meaning two, and 'fasciatus', meaning striped, referring to the double-striped abdomen.

2. *Trypeta californiensis*, sp.n. (Figs 3C, D, 6L, 7B, C, 8A, 10D, 12B, 13B, 15B, 17A)

Diagnosis. Differs from all other New World *Trypeta* species except *T. footei* by its sharply margined, dorsally

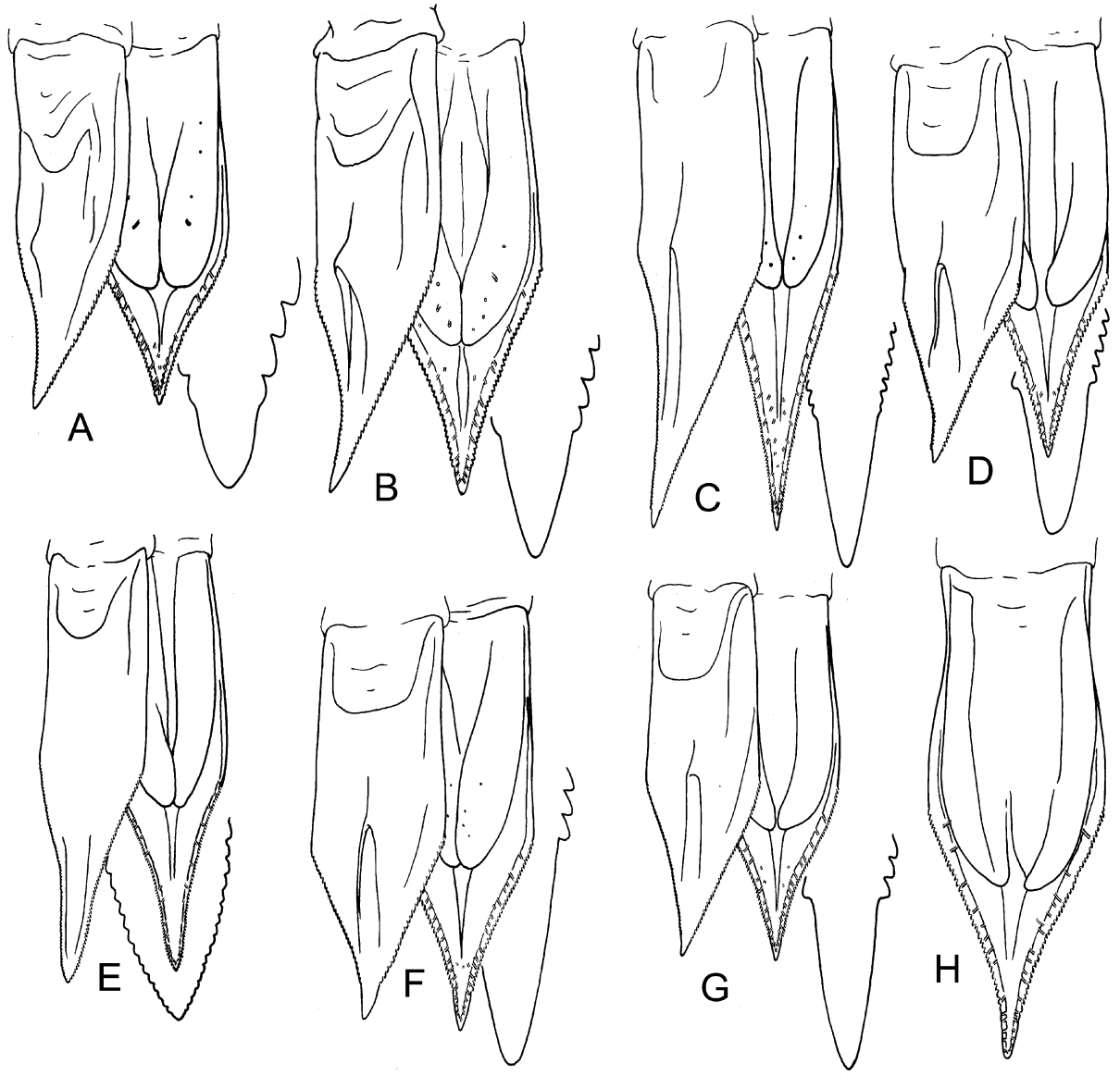

Fig. 14. Aculeus, dorsolateral and ventral views. A, *Trypeta inclinata*; B, *T. maculata*; C, *T. maculosa*; D, *T. melanoura*; E, *T. reducta*; F, *T. rufata*; G, *T. wulpi*; H, *T. striata*.

narrow facial carina and unusually short scutellar setae (at most 1.5× as long as scutellum). *Trypeta californiensis* differs from *T. footei* by having dark brown lateral bands on abdominal tergites 2–5 (Fig. 7B, C) and its wing pattern (Fig. 6L vs 6G, H), in particular the spot on crossvein H darker, and the discal band uninterrupted (often incomplete in *T. footei*).

Description. Body mostly shiny to subshiny yellow brown, with dark brown lateral bands on abdominal tergites; setae and setulae dark brown, setulae relatively longer than in other species. Head (Fig. 3C, D) with frontofacial angle about 95°; medial vertical seta 0.7× longest diameter of eye; lateral vertical seta 0.7× as long as medial vertical seta; postocellar seta 0.5× as long as medial vertical seta; paravertical seta 0.7× as long as postocellar seta; ocellar seta 1.5–2× as long as ocellar tubercle; arista entirely short pubescent; facial carina with sharp margins, dorsal part strong but very narrow (Fig. 3D); parafacial slightly wider than flagellomere 1; genal seta strong, dark brown; postocular setae extended 0.6× distance from dorsal eye margin to ventral eye margin. Thorax entirely yellow brown with dark brown setae and setulae; scutum shiny yellow brown with dense, relatively long setulae, entirely microtrichose; dorsocentral seta about 0.3× distance from level of postsutural supra-alar seta to intra-alar seta; scutellum with

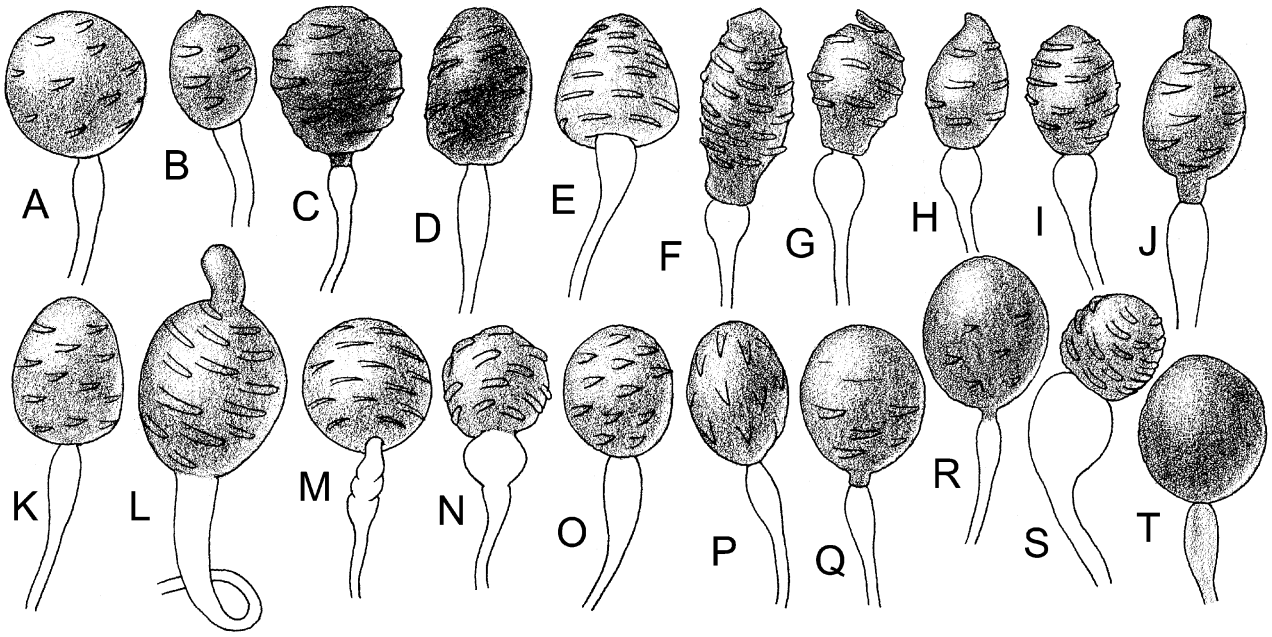

Fig. 15. Spermathecae. A, *Trypeta bifasciata*; B, *T. californiensis*; C, *T. concolor*; D, *T. costaricana*; E, *T. denticulata*; F–I, *T. flaveola*; J, *T. footei*; K, L, *T. fractura*; M, *T. inclinata*; N, *T. maculata*; O, *T. maculosa*; P, *T. melanoura*; Q, *T. reducta*; R, *T. rufata*; S, *T. striata*; T, *T. wulpi*.

basal seta 1.2× as long as scutellum and apical seta as long as scutellum; proepisternum densely covered with long dark brown setulae; anepisternum with 1 outstanding seta; mediotergite shiny yellow brown. Wing (Fig. 6L) hyaline with dark brown pattern, including: brown spot on cell bc, base of cell c, and br posterior to crossvein H; remainder of cell c, br basal to node of Rs, and most of bm and bcu faintly brown, more so in paratype; brown subcostal band from pterostigma, across fork of Rs to Cu_2, broadly connected to discal band, including in all of cell r_{2+3} basal to R-M; brown discal band, entirely brown in pterostigma, extending across R-M and cell dm, and in holotype into cell cu_1, in paratype broadly connected to subcostal band in cell dm by pale brown band; brown spot in middle of cell r_1, reaching costa, in paratype extending into cell r_{2+3} but not reaching vein R_{4+5}; brown subapical band covering DM-Cu, relatively broad, extending to wing margin along Cu_1, extending obliquely or steplike to vein R_{4+5}, with distinct bend and paler area or narrow break on vein M, section in cell r_{4+5} narrower and aligned slightly distally to spot in cell r_1; and large, ovoid or semicircular, dark brown apical band, extending into apex of cell r_1, with proximal margin convex; R_{4+5} with 6–7 tiny setulae between node and R-M, without any setulae apical to R-M; cell bm, base of cell r_1, and alula entirely microtrichose. Male abdomen yellow brown with dark brown lateral bands on syntergite 1 + 2 and tergites 3–5 (Fig. 7B); epandrium (Fig. 8A) dark brown; surstylus dark brown, apically truncated in profile; proctiger pale yellow; medial surstylus with lateral prensiseta much shorter than medial prensiseta; medial sclerite of glans with extensive internal sculpture pattern of round granulation (Fig. 10D); granules relatively large, spaced by distance longer than diameter of each granule; dorsal sclerite of glans with extensive internal sculpture pattern of apically pointed elongated granulation. Female abdomen shiny yellow brown, with dark brown lateral bands on syntergite 1 + 2 and tergites 3–5 (Fig. 7C); oviscape entirely dark brown, with pair of ventral marginal setae, no outstanding dorsal marginal setae (Fig. 12B); eversible membrane with taeniae about 0.5× as long as total length of membrane; aculeus (Fig. 13B) broad, more or less parallel-sided with apical half tapered; tip elongate triangular, margins nearly straight, with fine serrations to extreme apex; spermathecae dark brown, round in outline with transverse spinular papillae (Fig. 15B).

Material examined. Holotype, ♂, UNITED STATES: California: Marin Co., Alpine Lake, Lily Pond, 1500 ft, Malaise trap, 11.iv–9.v.1970 (D. D. Munroe) (CNC USNM00216047). Paratype, ♀, UNITED STATES: California: San Mateo Co., San Bruno Mountains, 20.iii.1963 (P. H. Arnaud, Jr.) (USNM USNM00216046).

Distribution. Known only from the U.S.A. (northern California) (Fig. 17A).

Etymology. The specific epithet is an adjective derived from the state of the type locality, California.

3. *Trypeta chiapasensis*, sp.n. (Figs 3E, 6N, 7D, 8B, 10E, 17B)

Diagnosis. Differs from other similar looking *Trypeta* species by having a hyaline marginal area in cell r_{2+3},

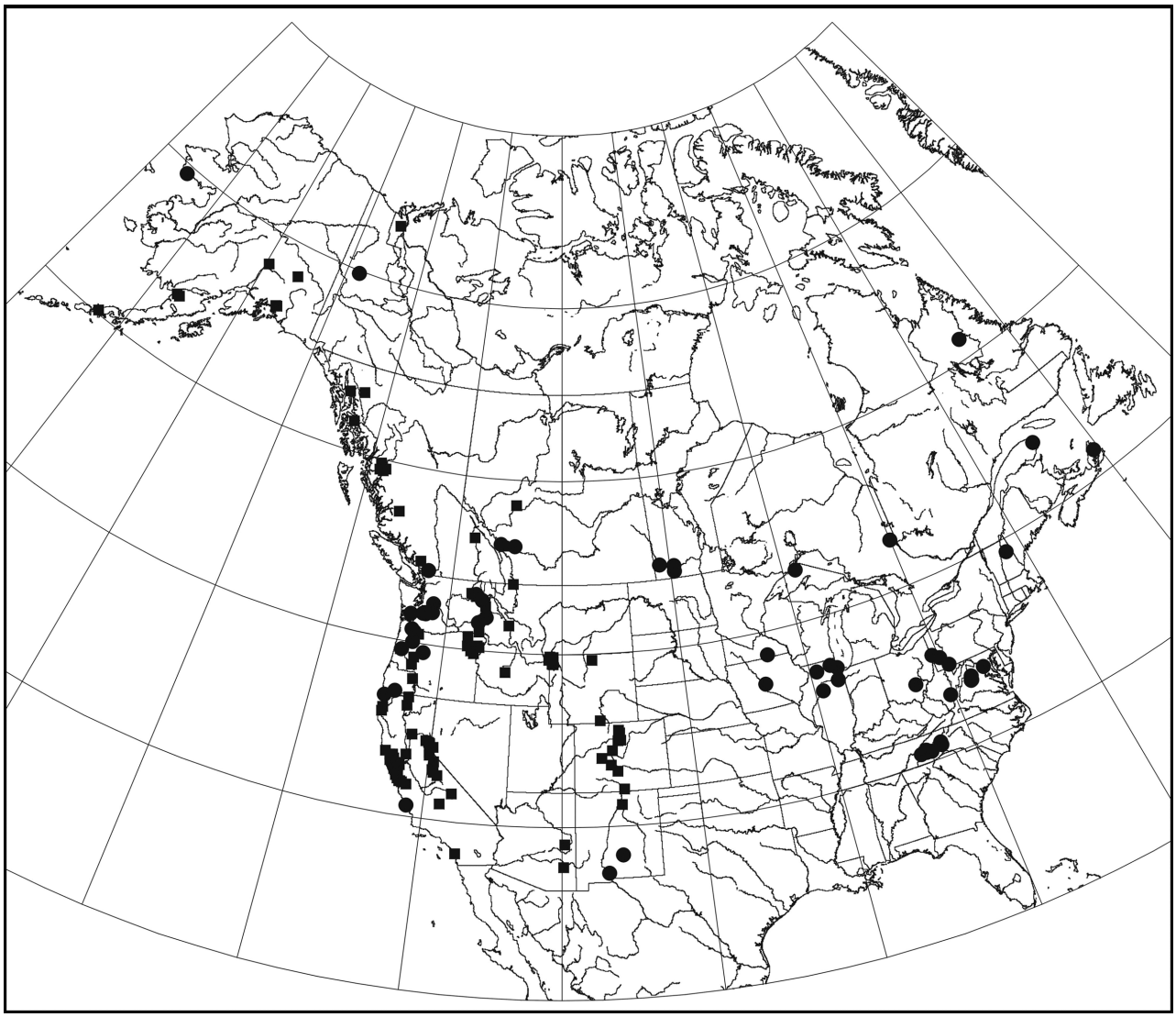

Fig. 16. Distribution map of *Trypeta flaveola*. Square, individuals with subapical wing band interrupted (Fig. 5A–C); circle, individuals with subapical wing band complete (Fig. 5D–F).

many relatively long setulae (*c*. 0.5× as long as R-M) on vein R_{4+5}, including more than 15 between R-M and the apex (Fig. 6N), and similar sized dark brown lateral bands on abdominal tergites 3–5 (Fig. 7D).

Description. Body mostly shiny to subshiny yellow brown, with dark brown lateral bands on abdominal tergites; setae and setulae dark brown. Head (Fig. 3E) with frontofacial angle about 105°; medial vertical seta as long as longest diameter of eye; lateral vertical seta 0.7× as long as medial vertical seta; postocellar seta 0.5× as long as medial vertical seta; paravertical seta 0.5× as long as postocellar seta; ocellar seta 2× as long as ocellar tubercle; arista bare except for basal fifth; facial carina with rounded margins, dorsal part broad; parafacial 0.4× as wide as flagellomere 1; genal seta strong, dark brown; postocular setae extended 0.6× distance from upper eye margin to ventral eye margin. Thorax entirely yellow brown with dark brown setae and setulae; scutum shiny yellow brown, with dense, relatively long setulae, entirely microtrichose; dorsocentral seta aligned with postsutural supra-alar seta; scutellum with basal seta 2.7× as long as scutellum and apical seta 2.3× as long as scutellum; proepisternum densely covered with long yellow brown setulae plus few dark brown setulae; anepisternum with 1 outstanding seta; mediotergite shiny yellow brown. Wing (Fig. 6N) hyaline with dark brown pattern, including: faint diffuse spot on crossvein H and diffuse markings in basal cells; orange brown band from fork of Rs to Cu_2, connected to discal band by paler area in cells r_1 and r_{2+3}; mostly brown discal band, entirely brown in pterostigma, extending across R-M and cells dm and cu_1 to posterior wing margin, strongly narrowed along R-M and

pale in dm; oblique brown spot in middle of cells r_1 and r_{2+3}, reaching costa and narrowly reaching vein R_{4+5}; brown subapical band covering DM-Cu, extending broadly to wing margin along Cu_1, extending obliquely across cell r_{4+5} to vein R_{4+5} distinctly distal to spot in cells in r_1 and r_{2+3}; brown spot at apex of cell r_1, extending into cell r_{2+3}; and nearly semicircular, dark brown apical spot, well separated from spot on apex of R_{2+3}; R_{4+5} with 8 relatively long setulae (*c*. 0.5× as long as R-M) between node and R-M, 17 additional setulae apical to R-M; cell bm, base of cell r_1, and alula, except along fold, entirely microtrichose. Male abdomen yellow brown with short, similar sized, dark brown lateral bands on tergites 3–5 (Fig. 7D); epandrium (Fig. 8B) dark brown; lateral surstylus apically pointed in profile, brown with apex dark brown; proctiger pale yellow; medial surstylus with lateral prensiseta much shorter than medial prensiseta (Fig. 8B); medial sclerite of glans with extensive internal sculpture pattern of round granulation (Fig. 10E); granules relatively large, spaced by distance longer than diameter of each granule; dorsal sclerite of glans without any internal sculpture pattern. Female unknown.

Type specimens. Holotype, ♂, MEXICO: Chiapas: 12 mi. NE of San Cristobal de las Casas, Mt. Tzontehuitz, 9400 ft, 27.v.1969 (B. V. Peterson) (USNM00216045) (CNC).

Distribution. Known only from the type locality, a highland site in southern Mexico (Chiapas) (Fig. 17B).

Etymology. The specific epithet is an adjective derived from the state of the type locality, Chiapas, Mexico.

4. *Trypeta concolor* (Wulp) (Figs 2, 3F, 6D, E, 8C, 10F, 12C, 13C, 15C, 17D)

Spilographa concolor Wulp, 1899: 408 (original description). *Trypeta concolor*: Foote, 1965b: 239 (lectotype designation). – Foote, 1967: 53 (in catalogue). – Han, 1992: 129 (in checklist). – Norrbom *et al*., 1999: 239 (in catalogue). *Phorellia concolor*: Hendel, 1914: 28 (in key, catalogue); Aczél, 1950: 250 (in catalogue); Aczél, 1954: 87 (taxonomy).

Diagnosis. Differs from all other New World *Trypeta* species except *T. denticulata* by the following combination of wing characters (Fig. 6D, E): (1) apical spot usually dark brown, broad, and ovoid or semicircular, usually well separated from apex of R_{2+3}; (2) apex of cell r_1 either hyaline or with tiny brown spot; and (3) cells dm and cu_1 hyaline except for base and apex. *Trypeta concolor* differs from *T. denticulata* by having crossvein R-M situated more distal to the midpoint of cell dm (M ratio 0.58–0.75 (Fig. 6D, E) vs 0.87–1.01 in *T. denticulata* (Fig. 6C)). The position of R-M differs only slightly between these two species, but is highly consistent among all the specimens examined in this study. Their postabdominal structures further separate *T. concolor* and *T. denticulata*: (1) epandrium dark brown vs yellow brown (Fig. 8C vs 8D); (2) oviscape dorsally with 4 pairs of marginal setae vs 1 pair (Fig. 12C vs 12E); (3) apical part of aculeus tip more flattened laterally than dorsoventrally vs more flattened dorsoventrally (Fig. 13C vs 13E); and (4) apical part of aculeus tip with lateral serrations extending onto dorsal side and merging into a single medial row, a character unique to *T. concolor*.

Redescription. Body almost entirely shiny to subshiny yellow brown except male abdominal tergites 3 and 4 often with brown to dark brown bands; setae dark brown; setulae yellow brown to dark brown. Head (Fig. 3F) with face slightly to strongly receding, frontofacial angle 75–90°; medial vertical seta 0.7–1.0× longest diameter of eye; lateral vertical seta 0.4–0.6× as long as medial vertical seta; postocellar seta 0.3–0.4× as long as medial vertical seta; paravertical seta 0.5–0.7× as long as postocellar seta; ocellar seta 1.5–2× as long as ocellar tubercle; arista entirely short pubescent; facial carina narrow, with rounded margins; parafacial about 0.5× as wide as flagellomere 1; genal seta strong, yellow brown; postocular setae extended 0.5× distance from upper eye margin to ventral eye margin. Thorax entirely yellow brown with dark brown to brown setae and setulae; scutum subshiny yellow brown, entirely microtrichose; dorsocentral seta aligned or nearly aligned with postsutural supra-alar seta; scutellum with basal seta 2–2.6× as long as scutellum and apical seta 1.7–2× as long as scutellum; proepisternum densely covered with long yellow brown setulae; anepisternum with single strong seta and sometimes 1 reduced hairlike seta ventral to it; mediotergite shiny yellow brown. Wing (Fig. 6D, E) hyaline with yellow brown to brown pattern, including: weak brown markings along fork of Rs, BM-Cu, and Cu_2, not connected to spot on pterostigma; brown or orange spot covering all of pterostigma, extending into cell r_1 posterior to it, often paler in pterostigma than in r_1; spot in middle of cell r_1, usually extending into cell r_{2+3} and reaching costa (usually broader there than along vein R_{2+3}); distinct brown spots bordering R-M and DM-Cu, that bordering DM-Cu usually extending along Cu_1 to wing margin; brown spot in middle of r_{4+5}, often faint, rarely absent, aligned between anterior end of DM-Cu and apex of R_{2+3}; and apical spot, usually dark brown, broad, and ovoid or semicircular, usually well separated from apex of R_{2+3}, occasionally approaching or touching it, but never extending into cell r_1, often with hyaline subapical spot within it in r_{4+5}. No spot on vein Cu_1 at middle of discal cell or at apex of cell r_1; R_{4+5} with 7–9 tiny setulae between node and R-M, 0–3 setulae apical to R-M; cell bm entirely microtrichose or with small to large bare area in basal two-thirds; base of cell r_1 and alula, except along fold, entirely microtrichose. Male abdomen yellow brown, sometimes with dark brown to brown medial bands on tergites 3 and 4, bands sometimes medially interrupted, sometimes extended almost to lateral margin; epandrium (Fig. 8C) dark brown; lateral surstylus brown with apex dark brown and pointed in profile, apex, in posterior view, with lateral lobe shorter than mesal lobe; proctiger

pale yellow; medial surstylus with lateral prensiseta much shorter than medial prensiseta; medial sclerite of glans poorly defined and not extensive, but with clear internal sculpture pattern of elliptic granulation (Fig. 10F); granules relatively small, spaced by distance longer than diameter of each granule; dorsal sclerite of glans with extensive internal sculpture pattern of apically pointed elongated granulation. Female abdomen entirely shiny yellow brown; oviscape entirely yellow brown with 4 pairs of strong dorsal marginal setae and a pair of tiny ventral marginal setae (Fig. 12C); eversible membrane with ventral taeniae about 0.5× as long as total length of membrane; ventrally on basal half with medial spinules relatively well developed, largest spinules 0.050 mm long; aculeus (Fig. 13C) broad, more or less parallel-sided with apical half tapered, tip with fine lateral serrations, near apex extending onto dorsal side and merging to form single medial row to apex; extreme tip laterally compressed, slightly broader in lateral view than in dorsal or ventral views; spermathecae brownish black, round in outline with sparse transverse spinular papillae (Fig. 15C).

Material examined. Lectotype, ♀, MEXICO: Distrito Federal: Mexico City, v.1888 (H. H. Smith) (BMNH), with the following labels: circular yellow bordered 'cotype'; 'Mexico City, May 88. H.H.S.', 'B.C.A. Dipt. II. Spilographa concolor, v.d.W.'; 'CENT. AMERICA. Pres. by F. D. Godman & O. Salvin. B.M. 1903–172.'; 'this specim. to be made lectotype by RHF' (Foote's writing). We added a lectotype label. Paralectotype, ♂, same data as lectotype (BMNH). See also Supplementary material.

Distribution. Widespread in highland areas of central Mexico (Distrito Federal, Guerrero, Jalisco, México, Michoacán, Morelos, Puebla, Veracruz) and apparently also southern Mexico (one record from Chiapas) (Fig. 17D).

Biology. Adults of *T. concolor* collected by A.L.N. were found only on or very near bushes of *Barkleyanthus salicifolius* (H.B.K.) H. Robins & Brett, a common roadside plant in central Mexico. Larvae were found in blotch leaf mines (Fig. 2) from which adults were reared at five sites in the Distrito Federal, México, Morelos, and Veracruz. Old mines were seen at most of the other locations where adults of *T. concolor* or *T. reducta* were collected. Two probably undescribed species of Braconidae (*Opius* sp. and *Utetes* sp., det. R. A. Wharton) were reared from *T. concolor* puparia in Morelos.

5. *Trypeta costaricana*, sp.n. (Figs 3G, 6I, 7E, 12D, 13D, 15D, 17D)

Diagnosis. Differs from its New World congeners by the following combination of characters: (1) arista bare except basally (Fig. 3G); (2) crossvein R-M at or basal to middle of cell dm (Fig. 6I); (3) vein R_{4+5} with at least 10 setulae between R-M and apex; (4) cell r_{2+3} without marginal hyaline area; and (5) female (probably also male) abdomen yellow brown with large dark brown lateral bands only on tergites 4–5 (tergite 3 sometimes with smaller lateral band or spot) (Fig. 7E).

Description. Body entirely shiny to subshiny yellow brown with dark brown lateral bands on at least abdominal tergites 4 and 5, and dark brown oviscape; setae and setulae dark brown. Head (Fig. 3G) with frontofacial angle about 110°; medial vertical seta about as long as longest diameter of eye; lateral vertical seta 0.7× as long as medial vertical seta; postocellar seta 0.5–0.8× as long as medial vertical seta; paravertical seta 0.5× as long as postocellar seta; ocellar seta 2.0–2.4× as long as ocellar tubercle; arista bare except basal area; facial carina with rounded margins, dorsal part moderately broad; parafacial narrow, less than 0.2× as wide as flagellomere 1; genal seta strong, dark brown; postocular setae extended 0.6–0.7× distance from upper eye margin to ventral eye margin. Thorax mostly to entirely shiny yellow brown with dark brown setae and setulae; mediotergite sometimes (4/10 types) with dark brown lateral spot; scutum entirely microtrichose; dorsocentral seta 0.1–0.2× distance from level of postsutural supra-alar seta to intra-alar seta; scutellum with basal seta 2.4–2.6× as long as scutellum and apical seta 2.0–2.3× as long as scutellum; proepisternum with 3–6 long dark brown setulae; anepisternum with 1–2 outstanding setae. Wing (Fig. 6I) hyaline with dark brown pattern, including: yellow or faint brown spot, often diffuse or absent, on cell bc, base of cell c, and br posterior to crossvein H; small marginal brown spot, sometimes absent, at basal two-fifths or mid-length of cell c; yellow or faint brown marks, often diffuse or absent, in cell br basal to node of Rs and cell bcu; brown band from fork of Rs to Cu_2, connected to discal band by usually paler or yellow area in cells r_1 and r_{2+3}; brown discal band covering all of pterostigma, extending broadly across R-M and at least slightly into cell dm, sometimes extending almost to posterior wing margin in cell cu_1, but often paler or ending in dm or interrupted there leaving isolated spot in cu_1; brown spot in middle of cell r_1, reaching costa, usually extending into cell r_{2+3}, sometimes extending to vein R_{4+5}; broad brown band covering DM-Cu, extending to wing margin along Cu_1, extending into cell r_{4+5}, often to R_{4+5}, or with separate spot in anterior half of r_{4+5}, spot or section in r_{4+5} often narrowed or shifted distally in that cell, always slightly distal to spot in middle of cell r_1; and large, nearly semicircular, dark brown apical spot, extending at least slightly into apex of cell r_1, with proximal margin usually convex; R_{4+5} with 8–12 setulae nearly 0.5× as long as R-M between node and R-M and 10–16 setulae apical to R-M; cell bm, base of cell r_1, and alula, except along fold, entirely microtrichose. Female abdomen yellow brown with dark brown lateral bands on tergites 4–5, sometimes with small lateral spots or (2 specimens) smaller lateral bands on tergite 3 (Fig. 7E); oviscape dark brown with medial yellow brown to brown area, with 1–2 pairs of long dorsal marginal setae and 1 pair of small ventral marginal setae (Fig. 12D); eversible membrane with taeniae over 0.5× as

long as total length of membrane; aculeus (Fig. 13D) broad, more or less parallel-sided with apical half tapered, tip with fine lateral serrations; spermathecae brownish black, elliptic in outline with transverse spinular papillae (Fig. 15D). Male unknown.

Material examined. Holotype, ♀, COSTA RICA: Cartago: 4 km NE of Cañon Genesis II, 2350 m, iv.1995 (P. Hanson) (INBio USNM00048928). Paratypes, COSTA RICA: Cartago: same as holotype, 1♀ (USNM USNM-00048633); Villa Mills, behind restaurant La Georgina, 3000 m, Malaise trap, v–vi.1989 (P. Hanson), 1♀ (INBio USNM00216043), 1♀ (USNM USNM00216565). San José: Cerro de la Muerte, Empalme, 19 km S and 3 km W, Malaise trap, iv–viii.1992 (P. Hanson), 1♀ (INBio USNM00216564), 1♀ (USNM USNM00216044); same, iv–v.1993, 1♀ (UCRSJ USNM00216563); 19 km S of Empalme, Mirador Quetzal, 2600 m, Malaise trap, iii.2000 (P. Hanson), 1♀ (USNM USNM00214193); same, v.2000, 1♀ (USNM USNM00214227); same, xi.1999, 1♀ (USNM USNM00214192).

Distribution. Known only from high elevation sites (>2000 m) in Costa Rica (Cartago, San José) (Fig. 17D).

Etymology. The specific epithet is an adjective derived from the country of the type locality, Costa Rica.

6. *Trypeta denticulata*, sp.n. (Figs 3H, 6C, 8D, 10G, 12E, 13E, 15E, 17B)

Diagnosis. See that of *T. concolor*.

Description. Body almost entirely shiny to subshiny yellow brown; with dark brown setae and yellow brown to dark brown setulae. Head (Fig. 3H) with face strongly receding, frontofacial angle 83–90°; medial vertical seta 0.7–0.8× longest diameter of eye; lateral vertical seta 0.5–0.7× as long as medial vertical seta; postocellar seta 0.3× as long as medial vertical seta; paravertical seta 0.5–1.0× as long as postocellar seta; ocellar seta reduced, 0.7–1.2× as long as ocellar tubercle; arista minutely pubescent on entire length, hairs shorter than basal width of arista (visible at 50× magnification); facial carina with rounded margins, dorsal part moderately broad; parafacial about 0.5× as wide as flagellomere 1; genal seta strong, dark brown; postocular setae extended 0.5× distance from upper eye margin to ventral eye margin. Thorax entirely yellow brown with dark brown setae and setulae; scutum subshiny yellow brown, entirely whitish microtrichose; dorsocentral seta aligned with or very slightly posterior to level of postsutural supra-alar seta; scutellum with basal seta 2.1–2.5× as long as scutellum and apical seta 1.6–1.9× as long as scutellum; proepisternum densely covered with long dark brown setulae; anepisternum with 1 strong seta and 1 reduced hairlike seta ventral to it; mediotergite shiny yellow brown. Wing (Fig. 6C) hyaline with yellow brown to brown pattern, including: weak brown markings along fork of Rs, BM-Cu, and Cu_2, not connected to spot on pterostigma; brown spot covering all of pterostigma, extending posteriorly into cell r_1; brown spot in middle of cell r_1, extending into cell r_{2+3} and reaching costa (usually as broad there as along vein R_{2+3}); distinct brown spots bordering R-M and DM-Cu, that bordering DM-Cu often extending along Cu_1 to wing margin; rarely (1/6 specimens), faint spot in middle of cell r_{4+5} aligned between anterior end of DM-Cu and apex of R_{2+3}; small brown spot at apex of cell r_1, sometimes faint, absent in Angangueo paratype; and broad, ovoid, dark brown apical spot, well separated from apex of R_{2+3}, sometimes with diffuse, hyaline subapical spot within it in r_{4+5}; no spot on Cu_1 near middle of discal cell; R_{4+5} with 1–3 tiny setulae between node and R-M, 0–3 setulae apical to R-M; cell bm entirely microtrichose or with small to large bare area in basal three-quarters; base of cell r_1 and alula, except along fold, mostly or entirely microtrichose. Male abdomen entirely yellow brown with dark brown setae and setulae; epandrium (Fig. 8D) yellow brown; lateral surstylus long, brown with dark brown apex pointed in profile, in posterior view, with lateral lobe much longer than mesal lobe; proctiger pale yellow; medial surstylus with lateral prensiseta much shorter than medial prensiseta; medial sclerite of glans poorly defined and less extensive but with clear internal sculpture pattern of round granulation (Fig. 10G); granules relatively small, spaced by distance longer than diameter of each granule; dorsal sclerite of glans with internal sculpture pattern largely reduced to reticulated pattern on anterior lower area. Female abdomen entirely shiny yellow brown; oviscape entirely yellow brown with 1 pair of small ventral marginal setae and 1 pair of strong dorsal marginal setae (Fig. 12E); eversible membrane with ventral taeniae about 0.5× as long as total length of membrane; ventrally on basal half with medial spinules not well differentiated, largest 0.023 mm long; aculeus (Fig. 13E) broad, more or less parallel-sided with apical half tapered, tip with fine lateral serrations extended almost to extreme apex; spermathecae yellow brown, conical with transverse spinular papillae (Fig. 15E).

Material examined. Holotype, ♂, MEXICO: Veracruz: road to Estación Microondas Las Lajas from Las Vigas de Ramirez, km 9, 2700–3000 m, sweeping *Senecio cinerarioides* H.B.K. (89M17), 19.viii.1989 (A. L. Norrbom & J. Valenzuela) (IEXV USNM00216025). Paratypes, same data as holotype, 1♂, 1♀ (USNM USNM00216027-28), 1♀ (IEXV USNM00216026). Distrito Federal: Ajusco, 2.xi.1978 (J. Butze), 1♀ (CNC USNM00216023). Michoacán: 6–8 km N of Angangueo, collected on *Senecio cinerarioides* (91M22C), 19.viii.1989 (A. L. Norrbom), 1♂ (USNM USNM00216024).

Distribution. Known from several highland areas of central Mexico (Distrito Federal, Michoacán, Veracruz) (Fig. 17B).

Biology. One larva, presumably of this species, was collected in a leaf mine on *Senecio cinerarioides* H.B.K., at km 16 (at 3100 m, almost to the microwave towers) higher on

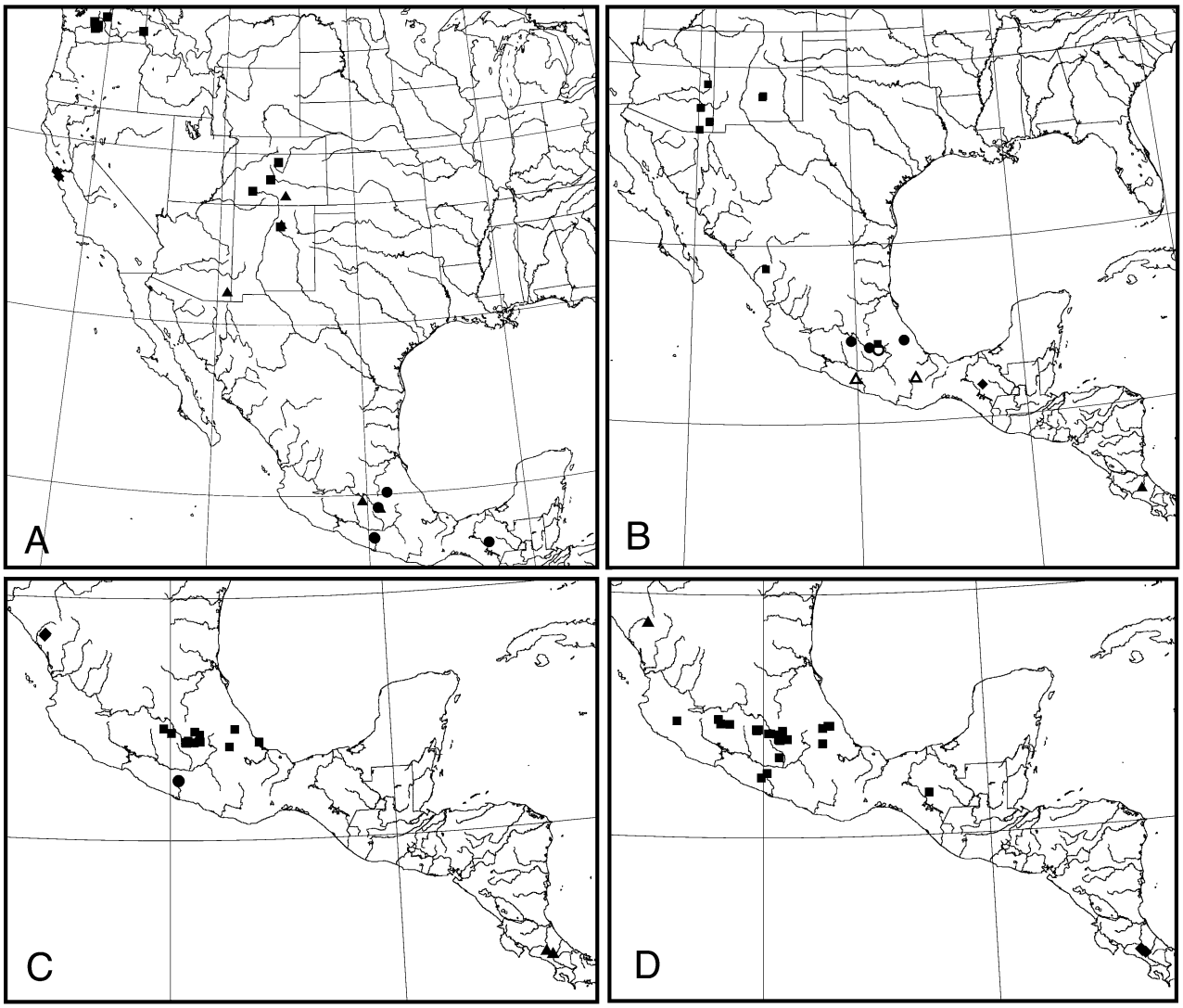

Fig. 17. Distribution maps. A, *Trypeta californiensis* (diamond), *T. footei* (square), *T. maculosa* (triangle), *T. rufata* (circle); B, *T. chiapasensis* (diamond), *T. denticulata* (circle), *T. flavifasciata* (hollow circle), *T. fractura* (square), *T. inclinata* (triangle), *T. melanoura* (hollow triangle); C, *T. maculata* (triangle), *T. reducta* (square), *T. striata* (circle), *T. wulpi* (diamond); D, *T. bifasciata* (triangle), *T. concolor* (square), *T. costaricana* (diamond).

the same road as the type locality. The larva pupariated, but no adult emerged. It is clearly a *Trypeta* species, with the characteristic pale yellow colour, the nearly semicircular arrangement of the lobes of the anterior spiracle, and the middle opening of the hind spiracle projecting laterally as in puparia of *T. concolor* and *T. flaveola*.

Etymology. The specific epithet is a Latin adjective meaning 'with small teeth' in reference to the minute scales of the eversible membrane of the female.

7. *Trypeta flaveola* Coquillett (Figs 3I–L, 5, 8E, 10H, 12F, G, 13F, 15F–I, 16)

Trypeta flaveola Coquillett, 1899a: 345 (original description). – Aldrich, 1905: 605 (in catalogue). – Foote, 1960: 259 (revision). – Foote, 1965a: 677 (in catalogue). – Richter & Kandybina, 1985: 28 (Russian records) – Han, 1992: 130 (taxonomy) – Foote *et al*., 1993: 452 (in key, taxonomy). – Han, 1998: 362 (host list). – Norrbom *et al*., 1999: 239 (in catalogue).

Trypeta (Acidia) tortile Coquillett, 1894: 71 (original description). **Syn.n.**
Acidia tortilis: Aldrich, 1905: 603 (in catalogue).
Phorellia tortilis: Phillips, 1923: 130 (review).
Trypeta tortile: Foote, 1960: 256 (revision). – Han, 1992: 133 (in checklist). – Foote *et al*., 1993: 449, 456 (in key, taxonomy).
Trypeta tortilis: Johnson, 1925: 261 (in New England list). – Foote, 1965a: 677 (in catalogue). – Norrbom *et al*., 1999: 240 (in catalogue). – Steck & Sutton, 2000: 256 (in Great Smoky Mountains National Park list).
Spilographa inaequalis Coquillett in Baker, 1904: 29 (original description). – Han, 1992: 130 (suggested synonym of *T. flaveola*). – Norrbom *et al*., 1999: 239 (synonym of *T. flaveola*).
Trypeta inaequalis: Foote, 1960: 259 (revision). – Foote, 1965a: 677 (in catalogue). – Foote *et al*., 1993: 452, 455 (in key, taxonomy).
Acidia sigma Phillips, 1923: 129 (original description); Han, 1992: 132 (suggested synonym of *T. tortilis*). – Norrbom *et al*., 1999: 239 (synonym of *T. tortilis*). **Syn.n.**
Trypeta sigma: Foote, 1960: 256 (revision). – Foote, 1965a: 677 (in catalogue). – Foote *et al*., 1993: 449, 456 (in key, taxonomy). – Han & McPheron, 1997: 25 (16S rDNA sequence).
Trypeta angustigena Foote, 1960: 258 (original description); Foote & Blanc, 1963: 88 (review, Calif.). – Frick & Hawkes, 1970: 1089 (biology, host). – Frick, 1971a: 20; 1971b: 6 (biology, hosts). – Frick, 1972: 21 (hosts). – Wasbauer, 1972: 139 (host list). – Han, 1992: 132 (suggested synonym of *T. tortilis*). – Norrbom *et al*., 1999: 239 (synonym of *T. tortilis*). **Syn.n.**

Diagnosis. Differs from all of the other New World species of *Trypeta* by its granulation pattern on the medial sclerite of the glans, which is extensive, with tiny, closely packed granules (Fig. 10H). Also distinguished by the following combination of external characters: body entirely yellow brown (without brown abdominal bands); face slightly to nonreceding; facial carina rounded; arista pubescent; and apical wing band well developed, extending into cell r_1. The subapical band is almost perpendicular to the long axis of the wing (Fig. 5D–F), or if interrupted (Fig. 5A–C), the spot in cell r_1 is more or less aligned with the mark on DM-Cu, although it is sometimes oblique.

Redescription. Body entirely subshiny yellow brown; with dark brown setae and yellow brown to dark brown setulae. Head (Fig. 3I–L) with frontofacial angle 100–110°; medial vertical seta about 0.7–1.0× longest diameter of eye; lateral vertical seta 0.5–0.7× as long as medial vertical seta; postocellar seta 0.3–0.5× as long as medial vertical seta; paravertical seta about 0.5× as long as postocellar seta; ocellar seta about as long to slightly longer than ocellar tubercle; arista entirely short pubescent; facial carina with rounded margins, dorsal part moderately broad to broad; parafacial 0.3–1.0× as wide as flagellomere 1; genal seta strong, dark brown; postocular setae extended 0.5–0.6× distance from upper eye margin to ventral eye margin. Thorax entirely yellow brown with dark brown setae and setulae; scutum subshiny yellow brown, entirely microtrichose; dorsocentral seta aligned slightly posterior to postsutural supra-alar seta; scutellum with basal seta 2.0–2.1× as long as scutellum and apical seta 1.5–1.9× as long as scutellum; proepisternum densely covered with long yellow brown and dark brown setulae; anepisternum with 1 strong seta and sometimes 1 reduced hairlike seta ventral to it; mediotergite shiny yellow brown. Wing (Fig. 5) hyaline with brown to dark brown, highly variable pattern, including: pale brown or yellow spot, diffuse, often absent, bordering crossvein H and in cell br posterior to it, sometimes covering all of cell bc; sometimes additional diffuse yellow markings in basal cells, especially in middle of cell c (or cell c occasionally with more discrete brown spot), cell br basal to fork of Rs, or bcu; narrow band or series of spots from fork of Rs to Cu_2, sometimes mostly yellow, especially in eastern specimens, but darker bordering fork of Rs and lobe of cell bcu, usually connected to mark on pterostigma in cell r_1 and especially in eastern specimens in cell r_{2+3}; cell dm sometimes (especially in specimens with darker wing patterns) yellow between base and mark on R-M; brown mark on pterostigma and posterior to it in cell r_1 in eastern specimens and some western specimens crossing R-M and extending into cell cu_1 to form complete or nearly complete discal band, in western specimens often interrupted in cell r_{2+3} and/or cell dm (i.e. a separate spot present bordering R-M and usually another in posterior third of cell dm and/or in cell cu_1); pterostigma mostly to entirely brown or, especially in eastern specimens, with as much as basal two-thirds yellow; discal band or spot in cell cu_1 sometimes connected to subapical band along posterior wing margin, more commonly in eastern specimens; brown subapical band uninterrupted in eastern specimens and some western specimens, from middle of cell r_1, across DM-Cu, to posterior wing margin along Cu_1, often narrower or paler or with proximal bend in cells r_{2+3} or r_{4+5}; if subapical band interrupted, brown spot in middle of cell r_1, usually extending into cell r_{2+3}, but often not reaching R_{4+5}, often oblique; and large brown anterior apical band, crescentic to semicircular, extended at least slightly into cell r_1, occasionally connected to subapical band or spot in middle of cell r_1 along costa; R_{4+5} with 4–11 tiny setulae between node and R-M, 0–4 setulae apical to R-M; cell bm entirely microtrichose or with small to large bare area in basal three-quarters; base of cell r_1 and alula, except along fold, mostly or entirely microtrichose. Male abdomen entirely shiny yellow brown with dark brown setae and setulae; epandrium (Fig. 8E) brown; lateral surstylus yellow brown, long, apically dark brown and truncated in profile; proctiger pale yellow; medial surstylus with lateral prensiseta much shorter than medial prensiseta; medial sclerite of glans with extensive sculpture pattern of tiny, tightly packed, round granulation (Fig. 10H); dorsal sclerite of glans with internal sculpture pattern of dense elongate

granulation. Female abdomen entirely shiny yellow brown; oviscape brown often with 1 pair of small ventral marginal setae and 1 pair of small dorsal marginal setae (Fig. 12F, G); eversible membrane with ventral taeniae about 0.5× as long as total length of membrane; aculeus (Fig. 13F) broad with apical two-fifths tapered, tip with fine lateral serrations; spermathecae (Fig. 15F–I) dark brown, round to elliptic in outline with transverse spinular papillae.

Material examined. Holotype ♀ of *flaveola*, RUSSIA: Kamchatskaya: Commander Islands, Bering Island, vii–viii.1897 (L. Stejneger) (USNM USNM00215904), with the following labels: 'Bering Island, July–August 1897, L. Stejneger'; (in red) 'Type no. 4053, U.S.N.M.'; 'Trypeta flaveola Coq.'; and 'Spilographa flaveola Coq.'; entire left wing and anteroapical portion of right wing missing; wing pattern similar to Fig. 5A, and head similar to Fig. 3J. Holotype ♀ of *angustigena*, UNITED STATES: California: San Luis Obispo Co., San Simeon, 25.ix.1938 (M. Cazier) (USNM USNM00215973), with the following labels: 'San Simeon IX-25–38, Cal, M. Cazier'; (red) 'USNM Type no. 64720'; and 'Trypeta angustigena Foote det. RHFoote 1959 HOLOTYPE'; in good condition with the dissected abdomen in a genitalia vial; the wing pattern similar to Fig. 5D, but the subapical band narrower. Holotype ♀ of *inaequalis*, UNITED STATES: Nevada: Carson City (Ormsby Co.), W of Carson City, head of Kings Canyon, 6.vii (Baker) (USNM USNM00215967) (specific locality is stated in introduction of Baker (1904: 17)), with the following labels: 'Ormsby Co., Nev., July 6, Baker'; (red) 'Type no. 6716, U.S.N.M.'; and 'Spilographa inaequalis Coq.'; we added a holotype label. Its head (similar to Fig. 3K) is detached and glued on the label; both wings and the anterior right portion of the scutum are damaged; the wing pattern is similar to Fig. 5B but with a larger round spot posterior to vein Cu_1. Holotype ♀ of *sigma*, UNITED STATES: Maryland: Montgomery Co., Plummers Island, near, 20.vi.1916 (R. C. Shannon) (USNM USNM00215987), with the following labels: 'Md near Plummers Id 20.6.16 Md'; 'R C Shannon Coll'; 'Acidia sigma Tarris ♀'; and (red) 'Holotype, Cornell U.'; in good condition but right wing missing; the wing pattern similar to Fig. 5F. Holotype ♀ of *tortilis*, UNITED STATES: Washington: (unspecified locality) (O. B. Johnson) (USNM USNM00215986), with the following labels: 'Was'; (red) 'Type no. 9834, U.S.N.M.'; 'Trypeta tortile Coq'; 'Spilographa tortile Coq.'; and 'HOLOTYPE ♀ Trypeta tortile Coquillett 1894: 71' (Norrbom's writing); in good condition, with the wing pattern similar to Fig. 5D, E. See also Supplementary material.

Distribution. Eastern Russia (Commander Island), western Canada and U.S.A. (Alaska and western Northwest Territories, south to the coast and mountains of California and the mountains of Arizona and New Mexico), northeastern and southern Canada, and northern and eastern U.S.A., south to the mountains of Tennessee and North Carolina (Fig. 16).

Biology. Mainly due to Frick (1971a), the biology of this species is better known than that of any New World congener, but much remains unknown. It has been reported (mostly as *T. angustigena*) to breed in fifteen species of Asteraceae. We examined specimens reared from all of these plants, except as indicated below. The paratypes of *T. angustigena* Foote (1960) ex *Delairea odourata* Lem. (as *Senecio mikanioides*) and *Artemisia suksdorfii* Piper (as *A. heterophylla*) are this species. Foote (1960) did not indicate the host status of these plants, and Foote & Blanc (1963: 93, 99) and Frick (1971a) were either ambiguous about this matter or treated these as foliage records, yet puparia pinned with these adults indicate rearing from these plants. Frick (1971b as cited by Wasbauer, 1972: 139) later reared additional specimens from *Delairea odourata* Lem. (as *Senecio mikanioides*), including one female that we examined. Frick (1971a, 1972) and Frick & Hawkes (1970) reared *T. flaveola* (as *T. angustigena*) from leaf mines on the following species of Asteraceae in California: *Arnica alpina* (L.) Olin, *A. chamissonis* Less. ssp. *foliosa* (Nutt.) Maguire, *A. montana* L., *Artemisia douglasiana* Bess., *Cacalia suaveolens* L. (no specimens examined), *Chrysanthemum* × *morifolium* Ramat., *Cynara scolymus* L. (no specimens examined), *Petasites palmatus* (Ait.) Gray, and *Senecio jacobaea* L., *S. paludosus* L., *S. serra* Hook, and *S. triangularis* Hook. Except for the records of *Chrysanthemum morifolium* and *Senecio jacobaea*, which were also based on flies reared from field-collected mines (Frick & Hawkes, 1970), these host records were based on laboratory garden studies for which the methods were not fully explained. Frick's statements about only rarely observing the adults and changing the arrangement of the potted plants suggest that conditions were largely natural and that females were not forced to oviposit on particular plants. Nevertheless, the status of these plants as normal field hosts needs confirmation, especially *Arnica montana*, *Cacalia suaveolens*, and *Senecio triangularis*, which Frick (1971a) considered to be of low preference. Of these species only *Arnica chamissonis*, *Artemisia douglasiana*, *A. suksdorfii, Petasites palmatus, Senecio serra*, and *Senecio triangularis* are native. Adults have been collected on *Senecio triangularis* and a *Senecio* sp. in Colorado, and on *Senecio jacobaea* in Oregon. In the east, Sutton *et al.* (2003; as *T. tortilis*) reared *T. flaveola* from blotch mines on *Senecio aureus* L.

Remarks. The concepts of *T. flaveola, angustigena, inaequalis, sigma* and *tortilis* used in the latest revisions of Nearctic *Trypeta* (Foote, 1960; Foote *et al*., 1993) were based on a limited number of specimens. These taxa were distinguished mainly by their head profiles (Fig. 3J–L; see also Foote *et al*., 1993: figs 484–486) and wing patterns (Fig. 5; see also Foote *et al*., 1993: figs 475, 476, 479–481). However, our study of numerous additional specimens shows continuous variation in these characters, even beyond the extent reported by Han (1992), and we found no consistent differences among those taxa, including in the genitalia. Possibly the populations we recognize as *T. flaveola* are a complex of cryptic species in which these

characters overlap, but based on the currently available morphological data, they appear more likely to form a single, widespread, geographically variable species. Additional biological and/or molecular studies could test this hypothesis.

Considerable clinal variation occurs in *T. flaveola*. Specimens from Russia, Alaska, western Canada, and many parts of the Rocky Mountains tend to have a wider parafacial and almost perpendicular face in profile (Fig. 3J), whereas those from California and the eastern part of the range usually have a narrow parafacial and more receding face (Fig. 3K, L), but there is much intergradation. The wing pattern varies greatly: in eastern specimens the discal and subapical bands are complete and they and the apical band are often broader and darker (Fig. 5E, F), more contrasting with the usually yellowish area across the basal cells and often the base of the pterostigma and posterior to it. The subapical band is often interrupted in western specimens (Fig. 5A–C), and the discal band is frequently reduced, especially in Californian specimens (Fig. 5B, C). But there are also western specimens with the subapical band complete (as in Fig. 5D), including among the series reared by Frick in California, and there are many specimens with intermediate patterns (e.g. with the subapical band narrowed, fainter, and/or basally curved in cells r_{2+3} and/or r_{4+5}) so that these characters intergrade (Fig. 16). The types of *T. sigma*, with broad, dark, connected bands forming a sideways 'S' (as in Fig. 5F), are at one end of this wing pattern variation, with the types of *T. flaveola, inaequalis*, and *angustigena*, with an interrupted or reduced discal band (Fig. 5A–D), at the opposite end, whereas the holotype of *T. tortilis*, which has only the discal and subapical bands connected, has an intermediate pattern (as in Fig. 5E).

Although the original description and some subsequent publications used the specific epithet *tortile* (neuter ending), should a valid species of *Trypeta* ever be recognized using this name, the correct spelling is *tortilis*, because *Trypeta* is feminine.

8. *Trypeta flavifasciata*, sp.n. (Figs 3M, 6F, 7K, 8F, 11A, 17B)

Diagnosis. Differs from its New World congeners by the following combination of characters: (1) arista bare except basally; (2) vein R_{4+5} with at least 10 setulae between crossvein R-M and apex; (3) male (probably female too) with dark brown lateral bands on abdominal syntergite 1 + 2 and tergites 3–5 (Fig. 7K); and (4) apex of wing slightly truncate (Fig. 6F).

Description. Body subshiny yellow brown with dark brown lateral bands on abdominal tergites; setae dark brown and setulae yellow brown to dark brown. Head (Fig. 3M) with frontofacial angle about 100°; medial vertical seta about as long as longest diameter of eye; lateral vertical seta about 0.5× as long as medial vertical seta; postocellar seta 0.4× as long as medial vertical seta; paravertical seta slightly shorter than postocellar seta; ocellar seta 0.4× as long as ocellar tubercle; arista bare except basal one-fifth; facial carina with rounded margins, dorsal part broad; parafacial 0.4× as wide as flagellomere 1; genal seta strong, brown; postocular setae extended 0.5× distance from upper eye margin to ventral eye margin. Thorax entirely yellow brown with dark brown setae and yellow brown to brown setulae; scutum subshiny yellow brown, entirely microtrichose; dorsocentral seta nearly aligned with postsutural supra-alar seta; scutellum with basal seta about 2.5× as long as scutellum and apical seta 1.9× as long as scutellum; proepisternum densely covered with long yellow brown and dark brown setulae; anepisternum with 1 outstanding seta; mediotergite shiny yellow brown. Wing (Fig. 6F) hyaline with brown to dark brown pattern, including: narrow, partially pale brown band from fork of Rs to Cu_2, connected to brown spot on pterostigma by yellow area in cell r_1 and base of pterostigma; brown spot in apical third of pterostigma and area posterior to it in cell r_1; brown spot on R-M; brown band in middle of cells r_1 and r_{2+3}, reaching costa and narrowly reaching vein R_{4+5}; brown band covering DM-Cu, extending to wing margin along Cu_1, but not extending into cell r_{4+5}; and dark brown apical band, extending into cell r_1, moderately broad in cell r_{4+5}, with proximal margin concave. No spots in cell cu_1 posterior to R-M or in middle of cell r_{4+5}; R_{4+5} with 7 relatively long setulae between node and R-M, 13 setulae apical to R-M; cell bm and base of cell r_1 entirely microtrichose; alula mostly bare. Male abdomen shiny yellow brown, syntergite 1 + 2 and tergites 3–5 with large dark lateral bands (Fig. 7K); epandrium (Fig. 8F) dark brown; surstylus yellow brown with dark brown apex sharply pointed in profile; proctiger pale yellow; medial surstylus with lateral prensiseta much shorter than medial prensiseta; medial sclerite of glans with extensive sculpture pattern of round granulation (Fig. 11A); dorsal sclerite of glans without internal sculpture pattern of round granulation. Female unknown.

Material examined. Holotype, ♂, MEXICO: México: Paso de Cortes, west side, 9500 ft, 13.viii.1954 (J. G. Chillcott) (CNC USNM00216020).

Distribution. Known only from the type locality, a highland site in central Mexico (Fig. 17B).

Etymology. The specific epithet is an adjective derived from the Latin 'flavus' meaning yellow and 'fasciatus' meaning striped, referring to the yellow brown medial longitudinal stripe on the abdomen (Fig. 7K).

9. *Trypeta footei*, sp.n. (Figs 3N, O, 6G, H, 9A, 11B, 12H, 13G, 15J, 17A)

Diagnosis. This species has the widest parafacial (Fig. 3O) among the New World *Trypeta* species. See diagnosis of *T. californiensis*.

Description. Body mostly subshiny yellow brown with dark brown setae and yellow brown to dark brown setulae. Head (Fig. 3N, O) with frontofacial angle about 95–101°; medial vertical seta about 0.6–0.8× longest diameter of eye; lateral vertical seta 0.5–0.6× as long as medial vertical seta; postocellar seta 0.3–0.4× as long as medial vertical seta; paravertical seta 0.5–0.7× as long as postocellar seta; ocellar seta 1.2–1.8× as long as ocellar tubercle; arista entirely short pubescent; facial carina with sharp margins, dorsal part strong but very narrow (Fig. 3N); parafacial usually about 1.5× as wide as flagellomere 1; genal seta strong, dark brown; postocular setae extended 0.5× distance from upper eye margin to ventral eye margin. Thorax entirely yellow brown with dark brown setae and setulae; scutum subshiny yellow brown, entirely microtrichose; dorsocentral seta 0.3–0.5× distance from level of postsutural supra-alar seta to intra-alar seta; scutellum with basal seta about 1.2× as long as scutellum and apical seta about as long as scutellum; proepisternum densely covered with long pale yellow setulae; anepisternum with 1 outstanding seta; mediotergite shiny yellow brown. Wing (Fig. 6G, H) hyaline with brown to dark brown variable pattern, including: yellow or faint brown spot, often diffuse or absent, on cell bc, base of cell c, and br posterior to crossvein H; yellow or faint brown marks, often diffuse or absent, in cell br basal to node of Rs, and/or cell bm and bcu; brown band from fork of Rs to Cu_2, usually connected to spot on pterostigma (or discal band) by yellow area in cell r_1 and sometimes cell r_{2+3}; brown mark covering all of pterostigma, extending into cell r_1 posterior to it, and often into cell r_{2+3} or connected to spot on R-M to form discal band; brown spot on R-M; brown spot in cell dm and/or cell cu_1, sometimes absent, slightly proximal to R-M, when connected to spot on R-M forming curved discal band; brown spot in middle of cells r_1 and r_{2+3}, usually broad, reaching costa, sometimes extending into cell r_{4+5} or connected to band over DM-Cu to form curved or steplike subapical band, but more commonly narrowly separated from it; broad brown band covering DM-Cu, extending to wing margin along Cu_1, usually extending into cell r_{4+5}, often to R_{4+5}, but narrowed or shifted distally in that cell, or rarely with separate spot in anterior half of r_{4+5}; and large, crescentic to semicircular, dark brown apical band, extending at least slightly into apex of cell r_1, with proximal margin usually straight to convex; R_{4+5} with about 12 tiny setulae between node and R-M, without setulae apical to R-M; cell bm, base of cell r_1, and alula, except sometimes along fold, entirely microtrichose. Male abdomen entirely shiny yellow brown with dark brown setae and setulae; epandrium (Fig. 9A) brown; surstylus yellow brown with dark brown apex truncated in profile; proctiger pale yellow; medial surstylus with lateral prensiseta much shorter than medial prensiseta; medial sclerite of glans with extensive sculpture pattern of round granulation (Fig. 11B); granules relatively large, spaced by longer than diameter of each granule; dorsal sclerite of glans with extensive internal sculpture pattern of apically pointed elongated granulation. Female abdomen shiny yellow; oviscape entirely brown with a pair of ventral marginal setae, no outstanding dorsal marginal setae (Fig. 12H); eversible membrane with taeniae about 0.5× as long as total length of membrane; aculeus (Fig. 13G) broad, more or less parallel-sided with apical half tapered, tip with fine lateral serrations except extreme apex; spermathecae dark brown, round in outline with apical projection and transverse spinular papillae (Fig. 15J).

Material examined. Holotype, ♂, UNITED STATES: Washington: Yakima Co., 4.7 mi. (7.6 km) ESE of Rimrock, Ahtanum Multiple Use Area (Wash. Department Natural Resources), 0.9 mi. NE of Louie Way Gap, 1658 m, em. after cold treatment, reared from leaves of *Senecio serra* Hook. coll. 29.vii.2001 (E. A. Lisowski) (USNM USNM00215621). Paratypes, UNITED STATES: Colorado: Chaffee Co., Garfield, 2 mi. W of, Monarch Pass, 10 000 ft, 20.vi.1981 (D. R. Smith), 1♀ (USNM USNM00216019). Park Co., Grant, Geneva Park, 8500–9500 ft, 23.vii.1916 (L. O. Jackson), 1♂ (USNM USNM00216018). San Juan Co., Silverton, 1♂ (USNM USNM00216017). New Mexico: Las Vegas Range, top of, 28 June, T. D. A. Cockerell, 1♀ (USNM USNM00216012). Washington: Chelan Co., Squilchuck State Park, 9 mi. SE of Wenatchee, 17.vi.1973 (W. J. Turner), 1♀ (WSU USNM00216014). Whitman Co., Pullman, vi (A. L. Melander), 1♀ (USNM USNM00216013). Yakima Co., 4.7 mi. (7.6 km) ESE of Rimrock, Ahtanum Multiple Use Area (Wash. Department Natural Resources), 0.9 mi. NE of Louie Way Gap, 1658 m, em. after cold treatment, reared from leaves of *Senecio serra* Hook. coll. 29.vii.2001 (E. A. Lisowski), 1♀ (USNM USNM00215622); Little Rattlesnake Creek, 7.5 mi. (12.1 km) NNE of Rimrock, 1109 m, em. after cold treatment, reared from leaves of *Senecio serra* Hook. coll. 9.vii.2000 (E. A. Lisowski), 1♂, 3♀ (USNM USNM00215623-26); Snoqualmie Natl. Forest, 8 mi. SW of Tieton Ranger Station, Bear Creek, 11–12.vi.1973 (M. Jackson), 1♀ (WSU USNM00216016); Snoqualmie Natl. Forest, 8 mi. SW of Tieton Ranger Station, Bear Creek, 3000 ft, Malaise trap, 15–17.vi.1973 (W. J. Turner), 1♀ (WSU USNM00216015); 10.1 mi. (16.2 km) SW of Rimrock, South Fork Tieton, USFS Road 1040-770, 1463 m, em. after cold treatment, reared from leaves of *Senecio serra* Hook. coll. 22.vii.2001 (E. A. Lisowski), 4♂, 7♀ (USNM USNM00215600-10), 1♂, 1♀ (YSUW USNM00215615-16), 1♂, 1♀ (FSCA USNM00- 215598-99), 1♂, 1♀ (CNC USNM00215613-14); Union Creek, 13.v.1923 (V. Argo), 6♀ (USNM USNM00216006-11); 5.7 mi. (9.1 km) NNE Rimrock, Wenatchee Natl. Forest, Naches R. D., end of Little Rattlesnake Road, near Coral Meadow, 1286 m, em. after cold treatment, reared from leaves of *Senecio serra* Hook. coll. 15.vii.2001 (E. A. Lisowski), 1♂, 2♀ (USNM USNM00215618-20); same, 1♀ (YSUW, USNM00215617).

Distribution. Western U.S.A. (Colorado, New Mexico, Washington) (Fig. 17A).

Biology. Reared by E. A. Lisowski from leaves of *Senecio serra* Hook.

Etymology. Named after Dr Richard H. Foote, who contributed much to the systematics of New World Tephritidae.

10. *Trypeta fractura* (Coquillett) (Figs 4A–D, 6J, K, 8G, 11C, 12I, 13H, 15K, L, 17B)

Spilographa fractura Coquillett, 1902: 125 (original description) – Aldrich, 1905: 604 (in catalogue).
Trypeta fractura: Foote, 1960: 258 (revision). – Foote & Blanc, 1963: 89 (review, Calif.). – Foote, 1965a: 677 (in catalogue). – Han, 1992: 130 (in checklist). – Foote *et al*., 1993: 450, 454 (in key, taxonomy). – Norrbom *et al*., 1999: 239 (in catalogue).

Diagnosis. Differs from its New World congeners by the following combination of characters: (1) crossvein R-M situated distinctly apicad of middle of cell dm (Fig. 6J, K); (2) face strongly receding, frontofacial angle distinctly smaller than 90° (Fig. 4A, C); (3) ocellar seta reduced to tiny setulae (much smaller than length of ocellar tubercle); (4) abdominal tergites yellow brown without dark brown lateral bands; (5) discal wing band interrupted; and (6) subbasal band well developed from pterostigma to apex of cell bcu.

Redescription. Body entirely subshiny yellow brown with yellow brown to dark brown setae and setulae. Head (Fig. 4A–D) with face strongly receding, frontofacial angle 80–85°; medial vertical seta 0.6–0.9× longest diameter of eye; lateral vertical seta 0.5–0.7× as long as medial vertical seta; postocellar seta 0.3–0.4× as long as medial vertical seta; paravertical seta as long as or shorter than postocellar seta; ocellar seta almost reduced or 0.7–0.8× as long as ocellar tubercle; arista entirely short pubescent; facial carina with rounded margins, dorsal part broad; parafacial 0.3–0.7× as wide as flagellomere 1; genal seta relatively weak, yellow brown; postocular setae extended 0.4–0.5× distance from upper eye margin to ventral eye margin. Thorax entirely yellow brown with dark brown setae and short yellow brown setulae; scutum subshiny yellow brown, entirely microtrichose; dorsocentral seta 0–0.5× distance from level of postsutural supra-alar seta to intra-alar seta; scutellum with basal seta 2.0–2.2× as long as scutellum and apical seta 1.6–1.8× as long as scutellum; proepisternum densely covered with long pale yellow setulae; anepisternum with 1 outstanding seta; mediotergite shiny yellow brown. Legs entirely yellow brown with yellow brown setae and setulae. Wing (Fig. 6J, K) hyaline with brown to dark brown pattern, including: yellow or faint brown spot, often diffuse or absent, bordering crossvein H and in cell br posterior to it; orange to brown subcostal band from pterostigma across fork of Rs to Cu_2, sometimes paler in cell r_1; pterostigma and area posterior to it in cell r_1 entirely brown, sometimes extending into cell r_{2+3} but always separate from spot on R-M; brown spot on R-M, sometimes narrow; brown spot in cell cu_1 slightly proximal to level of R-M, occasionally absent, often extending into cell dm, in 3 Arizona specimens connected to mark on DM-Cu; brown band in middle of cells r_1 and r_{2+3}, reaching costa but usually not vein R_{4+5}, sometimes broad, often oblique; brown subapical band covering DM-Cu, extending to wing margin along Cu_1, sometimes extending into cell r_{4+5}, but usually faintly so if reaching anterior two-thirds of this cell, or occasionally interrupted with small, faint spot in anterior half of r_{4+5}, this spot or section of band in r_{4+5} slightly distal to spot in cells r_1 and r_{2+3}; and dark brown apical spot, usually extending at least slightly into cell r_1 in U.S.A. specimens, occasionally narrowly connected along costa to spot in middle of r_1, but usually well separated from apex of vein R_{2+3} in Mexican specimens (in which apex of r_1 is hyaline), ovoid to almost semicircular, relatively broad in cell r_{4+5}; R_{4+5} with 5–12 tiny setulae between node and R-M, 2–3 setulae apical to R-M; cell bm, base of cell r_1, and alula, except along fold, entirely microtrichose. Male abdomen entirely shiny yellow brown with yellow brown to brown setae and setulae; epandrium (Fig. 8G) dark brown; lateral surstylus long, brown with dark brown apex truncated in profile; proctiger pale yellow; medial surstylus with lateral prensiseta much shorter than medial prensiseta; medial sclerite of glans with sculpture pattern of round granulation (Fig. 11C); granules relatively large, spaced by distance longer than diameter of each granule; dorsal sclerite of glans without any internal sculpture pattern of granulation. Female abdomen entirely yellow brown with yellow brown to brown setae and setulae; oviscape entirely brown with 2 pairs of distinct dorsal marginal setae, no outstanding ventral marginal setae (Fig. 12I); eversible membrane with taeniae about 0.5× as long as total length of membrane; aculeus (Fig. 13H) broad, more or less parallel-sided with apical half tapered, tip with fine lateral serrations extending to apex; spermathecae yellow brown to brown, round in outline with transverse spinular papillae, frequently with apical projection (Fig. 15K, L).

Material examined. Lectotype, ♂, here designated to stabilize the usage of this name, UNITED STATES: New Mexico: Otero Co., Sierra Blanca (White Mts.), South Fork Eagle Creek, 13.viii (C. H. T. Townsend) (USNM, USNM00216035), with the following labels: 'Coll. Townsend'; 'White Mts. 8.13 NM'; 'S Fk Eagle Cr Abt 8000 ft'; (red) 'Type no. 6262, U.S.N.M.'; and 'Spilographa fractura Coq.'; in good condition.

Distribution. Southwestern U.S.A. (Arizona, New Mexico) south to central Mexico (Durango, México, Michoacán) (Fig. 17B). The Pothole Meadows, California specimens reported by Foote & Blanc (1963: 89) as *T. fractura* are *T. flaveola*, and other records of this species from California are doubtful.

Remarks. Considerable variation exists in the position of crossvein R-M (vein M ratio 0.5–0.8), the frontofacial angle

(80–85°), the size of the dark spot on or posterior to vein Cu_1 at apical three-fifths of cell dm (missing in a few specimens), and the alignment of the spot on R-M with those in cells r_1 and r_{2+3} and in cu_1 (Fig. 6J, K). A few smaller Mexican specimens with a more receding face (Fig. 4C) and the spot on R-M aligned to nearly form an oblique radial–medial wing band (Fig. 6K) were thought initially to be a separate species, but we consider them conspecific with *T. fractura* because these characters vary only slightly more than in other species. More specimens and host associations will allow better understanding of this variability and should indicate if there are additional cryptic species within this taxon.

11. *Trypeta inclinata*, sp.n. (Figs 3P, 6T, 7F, 12J, 14A, 15M, 17B)

Diagnosis. See diagnosis of *T. maculata*.

Description. Body almost entirely shiny yellow brown with dark brown lateral marks on abdominal tergites 3–5; setae and setulae dark brown. Head (Fig. 3P) with frontofacial angle about 110°; medial vertical seta slightly shorter than longest diameter of eye; lateral vertical seta 0.6× as long as medial vertical seta; postocellar seta 0.5× as long as medial vertical seta; paravertical seta 0.4× as long as postocellar seta; ocellar seta 2.5× as long as ocellar tubercle; arista bare except for basal area; facial carina with rounded margins, dorsal part broad; parafacial about 0.3× as wide as flagellomere 1; genal seta broken (length and colour not available); postocular setae extended 0.6× distance from upper eye margin to ventral eye margin. Thorax entirely yellow brown with dark brown setae and setulae; scutum shiny yellow brown, without microtrichia except narrow anterior, posterior and lateral margins; dorsocentral seta slightly posterior to postsutural supra-alar seta; scutellum with basal seta 2.5× as long as scutellum and apical seta 2.3× as long as scutellum; proepisternum covered with long yellow brown to brown setulae; anepisternum with 1 strong seta and 1 reduced hairlike seta ventral to it; mediotergite shiny yellow brown. Wing (Fig. 6T) hyaline with yellow to light brown pattern, including: yellow basal area, including cells bc, c, bm and bcu, and bases of r_1 and br; oblique band (fused discal and subapical bands?) from pterostigma, across R-M and DM-Cu, covering all of base of cell r_{2+3}, mostly yellow anteriorly, brown posteriorly from R-M; oblique band from BM-Cu, across base of dm, to wing margin near middle of cell cu_1, connected to yellow basal area, brown from bend in cell dm posteriorly; brown spot on Cu_2 and base of A_1+Cu_2, connected to yellow basal area; and uninterrupted, isolated anterior apical band, extended basally beyond level of DM-Cu, and distally to apex of vein M, brown from apex of vein R_{2+3} posteriorly; R_{4+5} with about 13 tiny setulae between node and R-M, 11 setulae apical to R-M; cell bm and base of cell r_1 entirely microtrichose; alula entirely bare. Female abdomen with dark brown lateral spots on tergites 3–5 (Fig. 7F); oviscape entirely yellow brown with pair of strong dorsal marginal setae and no ventral marginal setae (Fig. 12J); eversible membrane with ventral taeniae about 0.5× as long as total length of membrane; aculeus (Fig. 14A) broad, more or less parallel-sided with apical half tapered, tip relatively short and broad, with fine lateral serrations almost to apex, dorsomedial projection relatively small; spermathecae (Fig. 15M) brown, round in outline with transverse spinular papillae; apex of spermathecal duct swollen and twisted. Male unknown.

Material examined. Holotype, ♀, COSTA RICA: San José: Zurqu' de Moravia, 10°3′N 84°1′W, 1600 m, Malaise trap, ii.1995 (P. Hanson) (INBio USNM00048920).

Distribution. Known only from the type locality in Costa Rica (San José) (Fig. 17B).

Remarks. The only available specimen is slightly teneral, and some measurements and ratios of its head may differ from hardened individuals. See also remarks under *T. maculata*.

Etymology. The specific epithet is an adjective derived from the Latin 'inclinatus' meaning inclined, referring to the oblique wing bands (Fig. 6T).

12. *Trypeta maculata*, sp.n. (Figs 4E, 6U, 7G, H, 9B, 11D, 12K, 14B, 15N, 17C)

Diagnosis. This species and *T. inclinata* differ from all other *Trypeta* species by their atypical wing pattern and venation (Fig. 6T, U), including: (1) 3 yellow and brown bands that lie at about a 45° angle to the long axis of the wing (similar in general appearance to the wing pattern of *Tomoplagia*), the middle of which covers both R-M and DM-Cu; and (2) crossvein R-M beyond apical one-fifth of cell dm. *Trypeta maculata* differs from *T. inclinata* by the oblique band crossing the base of cell dm ending distinctly closer to the apex of Cu_1 than that of A_1+Cu_2. These species can be further separated by their aculeus shape, which in *T. maculata* has a more pronounced mediodorsal projection, a more elongate tip, and slightly larger lateral serrations (Fig. 14B vs 14A).

Description. Body almost entirely shiny yellow brown with dark brown lateral bands on abdominal tergites 3–5; setae and setulae dark brown. Head (Fig. 4E) with frontofacial angle about 100°; medial vertical seta slightly shorter than longest diameter of eye; lateral vertical seta 0.5–0.6× as long as medial vertical seta; postocellar seta 0.4× as long as medial vertical seta; paravertical seta 0.6× as long as postocellar seta; ocellar seta 2.2–2.6× as long as ocellar tubercle; arista bare except for basal area; facial carina with rounded margins, dorsal part broad; parafacial about 0.5× as wide as flagellomere 1; genal seta strong, yellow brown; postocular setae extended 0.6× distance

from upper eye margin to ventral eye margin. Thorax entirely yellow brown with dark brown setae and setulae; scutum shiny yellow brown, without microtrichia except narrow anterior and lateral margins; dorsocentral seta nearly aligned with postsutural supra-alar seta; scutellum with basal seta 2.6–2.7× as long as scutellum and apical seta 2.3–2.4× as long as scutellum; proepisternum covered with long yellow brown to brown setulae; anepisternum with 1 strong outstanding seta; mediotergite shiny yellow brown. Wing (Fig. 6U) hyaline with yellow to light brown pattern, including: yellow basal area, including cells bc, c, bm and bcu, and bases of r_1 and br; oblique band (fused discal and subapical bands?) from pterostigma, across R-M and DM-Cu, covering all of base of cell r_{2+3}, mostly yellow anteriorly, brown from DM-Cu posteriorly; oblique band from BM-Cu, across base of dm, to wing margin at distal third of cell cu_1, connected to yellow basal area, brown from vein Cu_1 posteriorly; brown spot on Cu_2 and base of $A_1 + Cu_2$, connected to yellow basal area; and uninterrupted, isolated anterior apical band, extended basally beyond level of DM-Cu, and distally to apex of vein M, brown from apex of vein R_{2+3} posteriorly; R_{4+5} with about 12 tiny setulae between node and R-M, 13 setulae apical to R-M; cell bm and base of cell r_1 entirely microtrichose; alula entirely bare. Male abdomen yellow brown, with dark brown lateral spots or short bands on tergites 3–5 (Fig. 7H); epandrium (Fig. 9B) dark brown; lateral surstylus brown, with dark brown apex pointed in profile; proctiger pale yellow; medial surstylus with lateral prensiseta much shorter than medial prensiseta; medial sclerite of glans with relatively less extensive internal sculpture pattern of round granulation (Fig. 11D); granules spaced by distance longer than diameter of each granule; dorsal sclerite of glans reduced without any internal sculpture pattern of granulation. Female abdomen (Fig. 7G) with dark brown lateral spots or bands on tergites 3–5; oviscape entirely yellow brown with 1 pair of strong dorsal marginal setae and no ventral marginal setae (Fig. 12K); eversible membrane with ventral taeniae about 0.5× as long as total length of membrane; aculeus (Fig. 14B) broad, more or less parallel-sided with apical half tapered, tip with lateral serrations relatively large and dorsomedial projection more pronounced than in other *Trypeta* species; spermathecae yellow brown, round in outline with transverse fingerlike papillae (Fig. 15N).

Material examined. Holotype, ♂, COSTA RICA: San José: 4.6 km E of Villa Mills, Estacion Cuericí, LS 389400 499600, 2600 m, 21–26.ix.1995 (A. Picado) (INBio INBIO002435321). Paratypes, COSTA RICA: Cartago: 4 km NE of Cañon Genesis II, 2350 m, vi.1995 (P. Hanson), 1♀ (USNM USNM00048614), 1♀ (INBio USNM00216566).

Distribution. Known only from two high elevation sites (>2000 m) in Costa Rica (Cartago, San José) (Fig. 17C).

Remarks. *Trypeta maculata* and *T. inclinata* have atypical wing patterns and venation for *Trypeta*, and were thought initially to comprise a new genus of Trypetini. However, examination of the male and female postabdomens revealed two obvious synapomorphies linking these species to the majority of New World *Trypeta* (as the *concolor* clade in Fig. 1B; see also the Phylogenetic relationships section).

Etymology. The specific epithet is a Latin adjective meaning spotted, referring to the spotted abdomen (Fig. 7G, H).

13. *Trypeta maculosa* (Coquillett) (Figs 4F, 6M, 9C, 11E, 12L, 14C, 15O, 17A)

Spilographa maculosa Coquillett, 1899b: 261 (original description). – Aldrich, 1905: 604 (in catalogue). – Foote, 1960: 258 (type data).
Zonosema dubia Johnson, 1903: 102 (original description). – Cresson, 1929: 403 (taxonomy). – Foote, 1960: 257 (synonymy, type data).
Spilographa dubia: Aldrich, 1905: 604 (in catalogue).
Trypeta maculosa: Foote, 1960: 257 (revision). – Foote, 1965a: 677 (in catalogue). – Han, 1992: 131 (in checklist) – Foote *et al*., 1993: 449, 455 (in key, taxonomy). – Norrbom *et al*., 1999: 239 (in catalogue).

Diagnosis. Differs from its New World congeners by its characteristic wing pattern and venation (Fig. 6M), including: (1) discal band complete from pterostigma into cell cu_1; (2) subapical band markedly incomplete; and (3) crossvein R-M distinctly basal to middle of cell dm.

Redescription. Body entirely subshiny yellow brown; setae and setulae yellow brown to dark brown. Head (Fig. 4F) with face receding, frontofacial angle about 90°; medial vertical seta slightly shorter than longest diameter of eye; lateral vertical seta 0.4× as long as medial vertical seta; postocellar seta about 0.4× as long as medial vertical seta; paravertical seta about 0.5× as long as postocellar seta; ocellar seta 1.5× as long as ocellar tubercle; arista entirely short pubescent; facial carina with rounded margins, dorsal part broad; parafacial about 0.4× as wide as flagellomere 1; genal seta strong, dark brown; postocular setae extended 0.5× distance from upper eye margin to ventral eye margin. Thorax entirely yellow brown with dark brown setae and yellow brown setulae; scutum shiny yellow brown, entirely microtrichose; dorsocentral seta 0.3× distance from level of postsutural supra-alar seta to intra-alar seta; scutellum with basal seta 2× as long as scutellum and apical seta 1.5× as long as scutellum; proepisternum covered with long dark brown setulae; anepisternum with 1 outstanding seta; mediotergite shiny yellow brown. Legs entirely yellow brown with dark brown setae and yellow brown setulae. Wing (Fig. 6M) hyaline with brown to dark brown pattern, including: brown spot, sometimes faint, bordering crossvein H and in cell br posterior to it; narrow brown band from fork of Rs to Cu_2, connected to discal band by usually paler or yellow area in cells r_1 and r_{2+3}; uninterrupted brown

discal band covering all of pterostigma, extending across R-M to at least slightly posterior to vein M but not more than two-thirds across cell cu_1; brown spot in middle of cell r_1, reaching costa, extending at least slightly into cell r_{2+3}, sometimes reaching vein R_{4+5}; broad brown band covering DM-Cu, extending to wing margin along Cu_1, extending at most slightly into cell r_{4+5}; brown spot in apex of cell r_1, absent in Veta Pass, Colorado female and *dubia* lectotype, in other U.S.A. specimens connected to apical spot; and large, nearly semicircular to ovoid, dark brown apical spot, well separated from apex of R_{2+3} or in some U.S.A. specimens connected, usually narrowly, to spot in apex of cell r_1. No spot in middle of cell r_{4+5}; R_{4+5} with 3–6 tiny setulae between node and R-M, about 5 setulae apical to R-M; cell bm with small to large nonmicrotrichose area in basal two-thirds; base of cell r_1 and alula, except along fold, microtrichose. Male abdomen entirely shiny yellow brown with yellow brown to brown setae and setulae; epandrium (Fig. 9C) brown to dark brown; lateral surstylus yellow brown with dark brown apex truncated in profile; proctiger pale yellow; medial surstylus with lateral prensiseta much shorter than medial prensiseta; medial sclerite of glans with sculpture pattern of round granulation (Fig. 11E); granules relatively large, spaced by distance approximately 2× as long as diameter of each granule; dorsal sclerite of glans with internal sculpture pattern largely reduced to reticulated pattern on anterior lower area. Female preabdomen similar to male; oviscape entirely brown with 2 pairs of distinct dorsal marginal setae, no outstanding ventral marginal setae (Fig. 12L); eversible membrane with taeniae about 0.5× as long as total length of membrane; aculeus (Fig. 14C) broad, more or less parallel-sided with apical half tapered, tip relatively long and slender with very fine lateral serrations; spermathecae brown, round in outline with transverse spinular papillae (Fig. 15O).

Material examined. Lectotype ♂ of *maculosa*, here designated to stabilize the usage of this name, UNITED STATES: Colorado: (unspecified locality) (USNM, USNM00216003), with the following labels: 'Col.'; (in red) 'Type no. 4399, U.S.N.M.'; and 'Spilographa maculosa Coq.?'. Condition good except the right wing apex is damaged and the dissected abdomen is in a genitalia vial. Crossvein BM-Cu is absent (right wing) or incomplete (left wing). Lecotype ♂ of *dubia*, here designated to stabilize the usage of this name, UNITED STATES: New Mexico: Beulah, 17.viii (Skinner) (ANSP), with the following labels: 'Beulah, N. Mex., 8/17, Skinner', and (in red) 'Type, *Zonosema dubia* Johnson, 6168.' *Zonosema dubia* was described without indication of the sex or number of type specimens. The single male type specimen in the ANSP is therefore designated as lectotype. See also Supplementary material.

Distribution. High elevation areas of the southwestern U.S.A. (Colorado, Arizona, New Mexico) to central Mexico (Michoacán, Distrito Federal) (Fig. 17A).

Biology. The only known host plant, *Senecio stoechadiformis*, is a low shrub, near Angangueo growing in association with *Senecio cinerarioides*, a larger shrub which is the likely host of *T. denticulata*.

14. *Trypeta melanoura*, sp.n. (Figs 4G, 6P, 7I, J, 9D, 11F, 12M, 14D, 15P, 17B)

Diagnosis. The only New World *Trypeta* species having the mediotergite entirely dark brown. Similar in some ways to *T. rufata*, especially in wing pattern (Fig. 6P vs 6O), but differs by the above character and the dark brown bands on its abdominal tergites (Fig. 7I, J). The frequent lack of acrostichal setae, absent otherwise only in *T. bifasciata*, is usefully diagnostic (see Remarks).

Description. Body entirely shiny to subshiny yellow brown, setae and setulae yellow brown to dark brown. Head (Fig. 4G) with frontofacial angle about 100°; medial vertical seta about as long as longest diameter of eye; lateral vertical seta about 0.5× as long as medial vertical seta; postocellar seta about 0.5× as long as medial vertical seta; paravertical seta about 0.5× as long as postocellar seta; ocellar seta 1.2–1.5× as long as ocellar tubercle; arista entirely short pubescent; facial carina with rounded margins, dorsal part broad; parafacial about 0.5× as wide as flagellomere 1; genal seta brown in males, dark brown in females; postocular setae extended 0.5× distance from upper eye margin to ventral eye margin. Thorax almost entirely subshiny yellow brown, often (4/7 types) with presutural brown spot and/or postsutural brown vitta aligned with intra-alar seta; scutum subshiny yellow brown with yellow brown to brown setae and setulae, entirely microtrichose; acrostichal seta usually absent (see Remarks); dorsocentral seta nearly aligned with postsutural supra-alar seta; scutellum with basal seta 2× as long as scutellum and apical seta 1.8× as long as scutellum; proepisternum covered with long yellow brown setulae; anepisternum with 1 outstanding dark brown seta; katepisternal seta yellow brown to brown in males and dark brown in females; mediotergite and lower half of subscutellum shiny dark brown. Legs entirely yellow brown with yellow brown to dark brown setae and setulae. Wing (Fig. 6P) hyaline with brown to dark brown pattern, including: pale brown spot, very narrow, often absent, bordering crossvein H; narrow band or series of spots from fork of Rs to Cu_2, often faint, not connected to brown spot on pterostigma; brown spot covering at least distal half of pterostigma and area posterior to it in cell r_1, separated from spot on R-M, at least posterobasal corner of pterostigma yellow; brown spot on R-M; brown spot in cell cu_1 posterior to R-M, sometimes faint or absent, often extended into cell dm or faintly connected to spot on R-M; brown spot or band in middle of cell r_1, extended into cell r_{2+3}, reaching costa and sometimes vein R_{4+5}, oblique in Guerrero paratype; brown subapical band covering DM-Cu, extending to wing margin along

Cu_1, extending obliquely or steplike to vein R_{4+5}, with distinct bend or narrow break on vein M, sometimes partially paler in cell r_{4+5}; brown spot at apex of cell r_1, extending into cell r_{2+3}; and somewhat crescent-shaped or semicircular, dark brown apical band, at least narrowly separated from spot on apex of R_{2+3}, with proximal margin concave at least in cell r_{4+5}; R_{4+5} with 7–9 tiny setulae between node and R-M, about 3–7 setulae apical to R-M; cell bm, base of cell r_1, and alula, except along fold, entirely microtrichose. Male abdomen mostly shiny brown with dark brown setae and setulae (Fig. 7J); syntergite 1 + 2 yellow with small brown lateral bands; tergite 3 entirely dark brown, or often with narrow yellow brown spot or stripe; tergites 4–5 entirely dark brown; epandrium (Fig. 9D) dark brown; lateral surstylus yellow brown with dark brown apex pointed in profile; proctiger pale yellow; medial surstylus without lateral prensiseta; medial sclerite of glans with extensive sculpture pattern of round granulation (Fig. 11F); granules relatively small, spaced by distance approximately 2× as long as diameter of each granule; dorsal sclerite of glans with small area of internal sculpture pattern of reticulate granulation. Female preabdomen yellow brown with dark lateral bands on tergites 3–5 (Fig. 7I); tergite 6 yellow brown with 4 long marginal setae; oviscape entirely dark brown with 1 pair of strong dorsal marginal setae and 1 pair of strong ventral marginal setae (Fig. 12M); eversible membrane with taeniae about 0.5× as long as total length of membrane; aculeus (Fig. 14D) broad, more or less parallel-sided with apical half tapered, tip with fine but relatively large lateral serrations; spermathecae dark brown, elliptic in outline with vertical to oblique spinular papillae (Fig. 15P).

Material examined. Holotype, ♂, MEXICO: Oaxaca: Llano de Las Flores, 17–19.vii.1987 (R. A. Wharton) (IEXV USNM00215992). Paratypes, MEXICO: Guerrero: 42 km NW of El Paraiso, 2560 m, 7.viii.1986 (J. Rawlins & R. Davidson), 1♀ (CMP USNM00215989). Same data as holotype, 1♂ (IEXV USNM00216063), 1♂, 1♀ (TAMU USNM00215990-91), 2♂ (USNM USNM00215993-94).

Distribution. Known from only two sites in the mountains of central and southern Mexico (Guerrero, Oaxaca) (Fig. 17B).

Remarks. This species usually lacks acrostichal setae, but, among the seven examined specimens, one female has a complete pair and one male has a single seta only on the left side (the right side clearly lacks even a socket). More samples are needed to understand the variability of this character. According to our phylogenetic analysis, this is a close relative of *T. bifasciata*, which also lacks acrostichal as well as presutural supra-alar setae.

Etymology. The specific epithet is a noun derived from the Greek 'melan' meaning black, and 'oura' meaning tail, referring to the mostly black abdominal tergites in both sexes.

15. *Trypeta reducta*, sp.n. (Figs 4H, 6A, B, 7L, M, 9E, 11G, 12N, 14E, 15Q, 17C)

Diagnosis. Recognized by its highly reduced wing pattern, in which the pterostigma is at most yellowish, the spots along R-M and DM-Cu being faint, if present, and the lack of markings along BM-Cu and Cu_2 (Fig. 6A, B). Sometimes only the spotlike anterior apical band is visible clearly (Fig. 6A).

Description. Body almost entirely shiny to subshiny yellow brown except dark brown bands on abdominal tergites; setae dark brown and setulae yellow brown to dark brown. Head (Fig. 4H) with face slightly to strongly receding, frontofacial angle 75–90°; medial vertical seta about 0.7× longest diameter of eye; lateral vertical seta about 0.6× as long as medial vertical seta; postocellar seta 0.3–0.4× as long as medial vertical seta; paravertical seta about as long as postocellar seta; ocellar seta reduced, no longer than ocellar tubercle; first flagellomere occasionally partly to entirely dark brown; arista entirely short pubescent; facial carina narrow, with rounded margins; parafacial about 0.5× as wide as flagellomere 1; genal seta strong, yellow brown; postocular setae extended 0.5× distance from dorsal eye margin to ventral eye margin. Thorax entirely yellow brown with dark brown to brown setae and setulae; scutum subshiny yellow brown, entirely microtrichose; dorsocentral seta slightly anterior to level of postsutural supra-alar seta; scutellum with basal seta about 2.5× as long as scutellum and apical seta about 2× as long as scutellum; proepisternum covered with long yellow brown setulae; anepisternum with 1 strong seta and sometimes 1 reduced hairlike seta ventral to it; mediotergite shiny yellow brown. Wing (Fig. 6A, B) hyaline with much reduced yellow brown to brown pattern, including: spot in middle of r_1 and/or r_{2+3}, usually broadest along vein R_{2+3} and not reaching costa, sometimes faint or absent; faint spots, usually narrow, often absent, bordering DM-Cu and R-M, that bordering DM-Cu not extending along Cu_1 to wing margin; spot in middle of r_{4+5}, often faint or absent, aligned between anterior end of DM-Cu and apex of R_{2+3}; and apical spot, usually dark brown, broad, and ovoid or semicircular, usually well separated from apex of R_{2+3}, occasionally approaching or touching it, but never extending into cell r_1, often with hyaline subapical spot within it in r_{4+5}. Pterostigma sometimes yellowish but without brown spot, and cell r_1 posterior to it also hyaline. No spots or markings along Cu_2, BM-Cu or fork of Rs, on vein Cu_1 at middle of discal cell, or at apex of cell r_1; R_{4+5} with 1–3 tiny setulae between node and R-M, no setulae apical to R-M; cell bm, base of cell r_1, and alula, except along fold, entirely microtrichose. Male abdomen mostly brown with brown to dark brown setulae (Fig. 7L); syntergite 1 + 2 with large brown to dark brown submedial or sublateral bands, sometimes connected medially; tergites 3 and 4 brown to dark brown except extreme lateral margin, often with narrow yellow brown posterior band and/or medial stripe; tergite 5 brown to dark brown except narrow yellow brown posterior

band, broader medially; epandrium (Fig. 9E) dark brown; lateral surstylus brown with dark brown apex pointed in profile, in posterior view, with lateral lobe much longer than mesal lobe; proctiger pale yellow; medial surstylus with lateral prensiseta much shorter than medial prensiseta; medial sclerite of glans poorly defined and not extensive, but with clear internal sculpture pattern of elliptic granulation (Fig. 11G); granules relatively small, spaced by distance much longer than diameter of each granule; dorsal sclerite of glans with extensive internal sculpture pattern of apically pointed elongated granulation. Female abdomen (Fig. 7M) shiny yellow brown, tergite 3 sometimes and tergites 4 and 5 often with brown to dark brown medial or nearly complete bands, often interrupted medially; oviscape entirely brown to dark brown with 4 pairs of strong dorsal marginal setae and 1–2 pairs of smaller ventral marginal setae (Fig. 12N); eversible membrane with ventral taeniae about 0.5× as long as total length of membrane, ventrally on basal half with medial spinules relatively well developed, largest spinules 0.050 mm long; aculeus (Fig. 14E) broad, more or less parallel-sided with apical half tapered, tip more flattened dorsoventrally than laterally, with fine lateral serrations extended to apex; spermathecae brownish black, round with short neck in outline with sparse transverse spinular papillae (Fig. 15Q).

Material examined. Holotype, ♂, MEXICO: Morelos: Lagunas de Zempoala, path along Lago Zempoala, on *Barkleyanthus salicifolius* (89M1), 10–11.viii.1989 (A. L. Norrbom) (IEXV USNM00215811). Paratypes, MEXICO: Distrito Federal: 1 km N of La Cima, on Rt. 95 (libre), km 42–43, near train overpass, on *Barkleyanthus salicifolius* (89M1), 8.viii.1989 (A. L. Norrbom), 2♂ (IEXV USNM00215874-75); same, 20–26.ix.1991, 2♀ (USNM USNM00215866-67). México: Chapingo, mountain near, 10.x.1973 (M. Tidwell), 1♀ (CEAM USNM00215716); 6 km W of Lago Zempoala, on Rt. 890, km 9, collected on *Barkleyanthus salicifolius* (91M1D), 2.x.1991 (A. L. Norrbom), 5♂, 5♀ (IEXV USNM00215828-37), 8♂, 8♀ (USNM USNM00215812-27); Parque Popo-Izta, Rt. 451 (Amecameca-Cholula), km 17.6, on *Barkleyanthus salicifolius* (89M1), 13.viii.1989 (A. L. Norrbom), 3♂, 1♀ (IEXV USNM00215849-52), 4♂, 3♀ (USNM USNM00215843-48); Paso de Cortes, west side, 11 000 ft, 13.viii.1954 (J. G. Chillcott), 8♂, 10♀ (CNC USNM00215790-807); same, 9500 ft, 3♀ (CNC USNM00215708-10); 2 km W of Rio Frio, on Rt. 190D (México-Puebla), km 60, sweeping *Barkleyanthus salicifolius* (89M1), 14.viii.1989 (A. L. Norrbom), 2♂ (USNM USNM00215868-69). Michoacán: 2–4 km N of Angangueo, collected on *Barkleyanthus salicifolius*, 4–5.x.1991 (A. L. Norrbom), 5♂ (IEXV USNM00215859-63), 4♂ (USNM USNM00215855-58); Rt. 15, km 81, on *Barkleyanthus salicifolius* (A. L. Norrbom), 1♂, 1♀ (IEXV USNM00215864-65). Morelos: 5 km N of El Vigia, on Rt. 142, km 48–50, collected on *Barkleyanthus salicifolius* (91MB), 28.ix–1.x.1991 (A. L. Norrbom), 1♀ (USNM USNM00215854), 1♂ (IEXV USNM00215853); Huitzilac & Lagunas de Zempoala, between, km 9–10, collected on *Barkleyanthus salicifolius* (91M1A), 22–24.ix.1991 (A. L. Norrbom), 1♂, 2♀ (MCZ USNM00215773-75), 2♂, 2♀ (TAUI USNM00215769-72), 2♂, 5♀ (IEXV USNM00215762-68), 1♂, 1♀ (BMNH USNM00215760-61), 5♂, 8♀ (USNM USNM00215747-59); Lagunas de Zempoala, ravine near entrance, on *Barkleyanthus salicifolius* (89M1), 9–11.viii.1989 (A. L. Norrbom), 1♂, 4♀ (USNM USNM00215838-42); same, path along Lago Zempoala, 10–11.viii.1989, 3♂, 3♀ (YSUW USNM00215805-10), 2♂, 1♀ (TAMU USNM00215802-04), 1♂, 1♀ (FSCA USNM00215800-01), 2♂, 1♀ (USU USNM00215797-99), 2♂, 2♀ (IEXV USNM00215793-96), 8♂, 7♀ (USNM USNM00215778-92); Lagunas de Zempoala, collected on *Barkleyanthus salicifolius* (91M1A), 23–25.ix.1991 (A. L. Norrbom), 8♂, 4♀ (IEXV USNM00215736-46), 2♂, 2♀ (MHNG USNM00215732-35), 1♂ (NMW USNM00215731), 7♂, 5♀ (USNM USNM00215717-27), 1♂, 1♀ (CDFA USNM00215729-30), 1♂ (LACM USNM00215728); Mexico City, 10 mi. SW of, 29.vii.1976 (Peigler, Gruetzmacher, R. & M. Murray & J. C. Schaffner), 4♀ (TAMU USNM00215711-14). Puebla: 2 km E of Puebla-Veracruz border, Rt. 150 (Puebla – Orizaba), km 229, on *Barkleyanthus salicifolius* (89M1), 14.viii.1989 (A. L. Norrbom), 1♀ (USNM USNM00215715). Veracruz: Antón Lizardo, 1 mi. W of, 23.vii.1963, H. L. Willis, 1♀ (UKaL USNM00215676); Estación Microondas Las Lajas, km 16, 3100 m, sweeping *Barkleyanthus salicifolius* (89M1), 19.viii.1989 (A. L. Norrbom & J. Valenzuela), 1♂, 3♀ (USNM USNM00215870-73).

Distribution. Widespread in central Mexico (Distrito Federal, México, Michoacán, Morelos, Puebla, Veracruz), known mainly from mid to high elevations (Fig. 17C).

Biology. Although adults have not been reared from *Barkleyanthus salicifolius* (H.B.K.) H. Robins & Brett, it is probably a host of *T. reducta* as well as *T. concolor*. Adults of *T. reducta* were collected on bushes of this plant at ten widely separated localities. At Parque Popo-Izta three pairs were observed by ALN in copulation on it between 09.30 and 10.30 hours. Several females positioned themselves perpendicular to the leaf axis and exerted their aculei and appeared as if they might have been ovipositing. Another female exhibiting this behaviour was seen on *Barkleyanthus salicifolius* at the km 9–10 site in 1991, and additional pairs in copulation were observed there and at Lagunas de Zempoala.

Remarks. Specimens of *T. reducta* and *T. concolor* were collected together at four sites (one of which was very close to the denticulata type locality), indicating that the differences between them do not represent geographical variation.

Etymology. The specific epithet is a Latin adjective, referring to the highly reduced wing pattern (Fig. 6A, B).

16. *Trypeta rufata* (Wulp) (Figs 4I, 6O, 9F, 11H, 12O, 14F, 15R, 17A)

Spilographa rufata Wulp, 1899: 407 (original description).
Trypeta rufata: Foote, 1965b: 239 (lectotype designation). – Foote, 1967: 53 (in catalogue). – Han, 1992: 132 (in checklist). – Norrbom *et al*., 1999: 239 (in catalogue).
Phorellia rufata: Hendel, 1914: 28 (in key, catalogue). – Aczél, 1950: 251 (in catalogue).

Diagnosis. Differs from its New World congeners by the following combination of characters: (1) wing with small isolated dark spot at apex of vein R_{2+3}; (2) wing with discal band interrupted; (3) abdominal tergites entirely yellow brown; and (4) both acrostichal and presutural supra-alar setae present.

Redescription. Body entirely shiny to subshiny yellow brown with yellow brown to dark brown setae and setulae. Head (Fig. 4I) with frontofacial angle 100–110°; medial vertical seta slightly shorter than longest diameter of eye; lateral vertical seta 0.4–0.6× as long as medial vertical seta; postocellar seta 0.4–0.5× as long as medial vertical seta; paravertical seta 0.7–0.8× as long as postocellar seta; ocellar seta about 1.5× as long as ocellar tubercle; arista entirely short pubescent; facial carina with rounded margins, dorsal part broad; parafacial 0.4–0.5× as wide as flagellomere 1; genal seta strong, brown to dark brown; postocular setae extended 0.4× distance from dorsal eye margin to ventral eye margin. Thorax entirely subshiny yellow brown; scutum subshiny yellow brown with dark brown setae and brown setulae, with large medial nonmicrotrichose area in most specimens; dorsocentral seta nearly aligned with postsutural supra-alar seta; scutellum with basal seta 3× as long as scutellum and apical seta 2.6× as long as scutellum; proepisternum covered with long yellow brown setulae; anepisternum with 1 outstanding dark brown seta; mediotergite shiny yellow brown. Wing (Fig. 6O) hyaline with brown to dark brown pattern, including: diffuse, pale brown spot bordering crossvein H and in cell br posterior to it, often absent; narrow brown or pale brown band from fork of Rs to Cu_2, often connected to brown spot on pterostigma by brown or yellow area; brown spot covering most of pterostigma and area posterior to it in cell r_1, usually separated from spot on R-M, posterobasal corner of pterostigma yellow; brown spot on R-M, sometimes narrow; brown spot in cell cu_1 posterior to R-M (absent in Desierto de los Leones female), sometimes extended into cell dm or faintly connected to spot on R-M; brown spot or band in middle of cells r_1 and r_{2+3}, often narrow, sometimes oblique, reaching costa and usually vein R_{4+5}; brown subapical band covering DM-Cu, extending to wing margin along Cu_1, extending obliquely or steplike to vein R_{4+5}, with distinct bend or narrow break on vein M, sometimes paler in cell r_{4+5}; brown spot at apex of cell r_1, usually extending into cell r_{2+3}, sometimes (MCZ paralectotype) connecting to subapical band in cell r_{4+5}; and somewhat crescent-shaped or semicircular, dark brown apical band, at least narrowly separated from spot on apex of R_{2+3}, with proximal margin concave, sometimes with acute extensions along R_{4+5} or M; R_{4+5} with 9 tiny setulae between node and R-M, about 6 setulae apical to R-M; cell bm entirely microtrichose or with small or large bare area in basal three-quarters; cell r_1 basal to fork of Rs partially to entirely bare; alula entirely microtrichose, except along fold, to mostly bare, microtrichose only along margin. Male abdomen almost entirely shiny yellow brown with dark brown setae and setulae; tergite 4 with lateral corner darker; tergite 5 with anterolateral corner darker; epandrium dark brown (Fig. 9F); lateral surstylus yellow brown with dark brown apex pointed in profile, in posterior view, with mesal lobe longer than lateral lobe; proctiger pale yellow; medial surstylus with lateral prensiseta much smaller than medial prensiseta; medial sclerite of glans with sculpture pattern of fingerlike granulation (Fig. 11H); granules relatively small, spaced by distance approximately 2× as long as diameter of each granule; dorsal sclerite of glans with extensive internal sculpture pattern of reticulate granulation. Female preabdomen entirely yellow brown or (female from Desierto de los Leones) with moderate brown bands on tergites 3–5, setae and setulae dark brown; oviscape dorsally dark brown and ventrally yellow brown, with 1 pair of strong dorsal marginal setae (Fig. 12O); eversible membrane with taeniae about 0.5× as long as total length of membrane, ventrally on basal half with medial spinules moderately well differentiated, largest spinules 0.041 mm long; aculeus (Fig. 14F) broad, more or less parallel-sided with apical half tapered; tip with fine but relatively large lateral serrations extended almost to apex; spermathecae dark brown, round in outline with transverse spinular papillae (Fig. 15R).

Material examined. Lectotype, ♀, MEXICO: Guerrero: Omilteme, 8000 ft, viii (H. H. Smith) (BMNH), with the following labels: circular yellow bordered 'cotype'; circular purple bordered 'lectotype'; 'Omilteme, Guerrero, 8000 ft, Aug H.H. Smith'; 'B.C.A. Dipt. II. Spilographa rufata, v.d.W.'; 'CENT. AMERICA. Pres. by F. D. Godman & O. Salvin. B.M. 1903–172.'; and 'to be designated lectotype by Foote' (Foote's writing). We added a lectotype label. Much of the abdomen of the lectotype appeared dark brown due to discoloured underlying tissues, but the tergites were yellowish. See also Supplementary material.

Distribution. Highlands of central and southern Mexico (Chiapas, Distrito Federal, Guerrero, Hidalgo) (Fig. 17A).

17. *Trypeta striata* (Wulp) (Figs 4J, 6S, 7N, 14H, 15S, 17C)

Spilographa striata Wulp, 1899: 406 (original description).
Phorellia striata: Hendel, 1914: 28 (in key, catalogue).

Trypeta striata: Foote, 1965b: 240 (type data). – Foote, 1967: 54 (in catalogue). – Han, 1992: 133 (in checklist). – Norrbom *et al*., 1999: 240 (in catalogue).
Phorellia strigata Aczél, 1950: 251, missp.

Diagnosis. The atypical wing pattern (Fig. 6S) differs from all other *Trypeta* species. It is similar to those of *T. inclinata* and *T. maculata* in having an oblique band from BM-Cu to the distal half of cell Cu_1 and a slender, uninterrupted anterior apical band that curves proximal to the level of DM-Cu anteriorly, but it differs in having crossveins R-M and DM-Cu much further apart and covered by separate bands, and by its complete subapical band which is joined with the anterior apical band.

Redescription. Body almost entirely yellow brown with large dark brown lateral bands on abdominal tergites 3–5. Head (Fig. 4J) with frontofacial angle about 110°; medial vertical seta 0.8× longest diameter of eye; lateral vertical seta 0.5× as long as medial vertical seta; postocellar seta 0.4× as long as medial vertical seta; paravertical seta slightly shorter than postocellar seta; ocellar seta 2× as long as ocellar tubercle; arista bare except for basal area; facial carina with rounded margins, dorsal part broad; parafacial narrow; genal seta strong; postocular setae extended 0.7× distance from dorsal eye margin to ventral eye margin. Thorax entirely yellow brown; scutum yellow brown, entirely nonmicrotrichose; dorsocentral seta 0.3× distance from level of postsutural supra-alar seta to intra-alar seta; scutellum with basal seta 2.4× as long as scutellum and apical seta 1.9× as long as scutellum. Wing (Fig. 6S) hyaline with predominantly yellow brown pattern, including: yellow basal area, including cells bc, c, bm and bcu, and base of br; oblique discal band from pterostigma, across R-M, extending slightly into cell dm; oblique band from BM-Cu, across base of dm, to wing margin in apical third of cell cu_1; spot on Cu_2 and base of $A_1 + Cu_2$; uninterrupted subapical band crossing DM-Cu, anterior half curved basally; and uninterrupted anterior apical band, connected to subapical band at costal margin, extended to apex of vein M; cell bm and base of cell r_1 entirely microtrichose; alula entirely bare except anteriorly. Female abdomen with dark brown lateral bands on tergites 3–5 (Fig. 7N); oviscape entirely yellow brown except extreme apex dark brown; eversible membrane with ventral taeniae about 0.5× as long as total length of membrane; aculeus (Fig. 14H) broad, more or less parallel-sided with apical half tapered, tip with fine lateral serrations except extreme apex; spermathecae light brown, round in outline with transverse fingerlike papillae (Fig. 15S); spermathecal duct strongly swollen, almost as large as spermatheca. Male unknown.

Material examined. Described from a single specimen, a female (BMNH), which is therefore the holotype. Bearing the following labels: circular red-bordered 'type'; 'Sierra de las Aguas Escondidas, Guerrero, 9500 ft July, H.H. Smith'; 'B.C.A. Dipt. II. Spilographa striata, v.d.W.'; 'CENT. AMERICA. Pres. by F. D. Godman & O. Salvin. B.M. 1903–172'. We added a holotype label. Foote (1965b) reported the face to be strongly receding in the holotype, but it is not so in comparison with that of other species such as *T. concolor*. The wings are badly damaged (Fig. 6S) and the pterostigmal area is missing in both. van der Wulp's (1899) figure (Table 11, no. 24) shows it to be fully infuscated.

Distribution. Known only from the type locality in the mountains of southern Mexico (Guerrero) (Fig. 17C).

18. *Trypeta wulpi*, sp.n. (Figs 4K, L, 6R, 9G, 11I, 12P, 14G, 15T, 17C)

Diagnosis. Recognized by its characteristic wing pattern (Fig. 6R), which includes: bands relatively narrow, orange brown; anterior apical band clearly C-shaped, slender, but extended to apex of R_{2+3}; discal and subapical bands complete or nearly complete, the latter strongly obliquely slanted towards apex of R_{2+3}; and accessory costal band in cell r_1 between discal and subapical bands.

Description. Body entirely shiny to subshiny yellow brown with brown to dark brown setae and yellow brown to brown setulae. Head (Fig. 4K, L) with frontofacial angle about 110°; medial vertical seta 0.6–0.8× longest diameter of eye; lateral vertical seta 0.6–0.8× as long as medial vertical seta; postocellar seta 0.3× as long as medial vertical seta; paravertical seta about 0.7× as long as postocellar seta; ocellar seta about 2× as long as ocellar tubercle; arista entirely short pubescent; facial carina with rounded margins, dorsal part moderately broad; parafacial about 0.4× as wide as flagellomere 1; genal seta strong, brown; postocular setae extended 0.5× distance from dorsal eye margin to ventral eye margin. Thorax entirely yellow brown; scutum shiny yellow brown with dark brown setae and rather dense yellow brown setulae, with large medial nonmicrotrichose area, in male extending anteriorly to dorsocentral setae, in female to presutural supra-alars, and in both laterally to intra-alar line; dorsocentral seta nearly aligned with postsutural supra-alar seta to 0.25× distance from latter to intra-alar seta; scutellum with basal seta 2× as long as scutellum and apical seta 1.8× as long as scutellum; proepisternum covered with long yellow brown setulae; anepisternum with 1 outstanding dark brown seta; mediotergite shiny yellow brown. Wing (Fig. 6R) hyaline with pale brown to brown pattern, including: yellow or faint brown spot bordering crossvein H and in cell br posterior to it; narrow brown or pale brown subcostal band from fork of Rs to Cu_2, connected to brown area on pterostigma by yellow area in cells r_1 and r_{2+3}; narrow brown discal band from pterostigma, across R-M, cell dm, and midway across cell cu_1, sometimes paler in cell dm, posterobasal corner of pterostigma yellow; narrow brown band in middle of cells r_1 and r_{2+3}, sometimes pale or oblique, reaching costa and vein R_{4+5}; narrow brown subapical band covering DM-Cu, extending to wing margin along Cu_1, extending obliquely across cell r_{4+5} towards or to apex of vein R_{2+3},

including apex of cell r_1, interrupted or paler in middle of cell r_{2+3}; and relatively narrow, crescentic, brown apical band, narrowly connected to subapical band or spot on apex of R_{2+3}, broadest in cell r_{4+5} or along vein M; R_{4+5} with 8 tiny setulae between node and R-M, about 7 setulae apical to R-M; cell bm, base of cell r_1, and alula, except along fold, entirely microtrichose. Male abdomen almost entirely shiny yellow brown with brown setae and setulae; tergite 5 with 1 pair of small lateral bands; epandrium dark brown (Fig. 9G); lateral surstylus yellow brown with apex pointed in profile; proctiger pale yellow; medial surstylus without lateral prensiseta; medial sclerite of glans with sculpture pattern of round granulation (Fig. 11I); granules relatively large, spaced by distance approximately 2× as long as diameter of each granule; dorsal sclerite of glans with internal sculpture pattern largely reduced to reticulated pattern on anterior lower area. Female preabdomen entirely yellow brown with brown setae and setulae; oviscape brown with dark brown tinge marginally on posterior half, with 1 pair each of strong dorsal and ventral marginal setae (Fig. 12P); eversible membrane with taeniae about 0.5× as long as total length of membrane; aculeus (Fig. 14G) broad, more or less parallel-sided with apical half tapered, tip with fine but relatively large lateral serrations except on extreme apex; spermathecae almost completely black, round in outline (papillae not observed due to opacity; Fig. 15T).

Material examined. Holotype, ♂, MEXICO: Sinaloa: El Palmito, 8 mi. W of, 6000 ft, 15.vii.1964 (J. F. McAlpine) (CNC USNM00215996). Paratype, ♀, MEXICO: Sinaloa: El Palmito, 15 mi. W of, 5000 ft, 7.viii.1964 (W. R. M. Mason) (CNC USNM00215995).

Distribution. Known only from the Sierra Madre Occidental in northwestern Mexico (Sinaloa) (Fig. 17C).

Etymology. Named after Dr F. M. van der Wulp, who described three Mexican *Trypeta* species.

Supplementary material

Additional distributional data for *Trypeta concolor*, *T. flaveola*, *T. fractura*, *T. maculosa*, and *T. rufata* are available online at http://www.blackwellpublishing.com/products/suppmat/SEN/SEN268/SEN268sm/htm

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Appendix

Characters and character states used in the cladistic analysis of New World *Trypeta*.

1. *Genal height (distance between ventral eye margin and ventral genal margin anterior to genal seta)*: (0) shorter than 0.3× longest diameter of compound eye; (1) longer than 0.3× longest diameter of compound eye (Fig. 3C, O). This character is variable within other genera of the *Trypeta* group.
2. *Frontofacial angle (angle between frons and face in profile; imaginary lines are drawn from dorsal scape margin to ocellar triangle, and again from dorsal scape margin to ventral facial margin)*: (0) right to obtuse (90° or greater); (1) acute (distinctly less than 90°; Figs 3F, H, 4A, C, F, H). State 1 is rare in other genera of the *Trypeta* group, and is probably apomorphic within *Trypeta*.
3. *Ocellar setae*: (0) distinct, at least as long as ocellar tubercle; (1) reduced, shorter than ocellar tubercle. This character varies among other genera of the *Trypeta* group.
4. *Arista*: (0) short pubescent along whole length (clearly visible under 50× magnification); (1) bare except for basal area. State 1 is unique within the *Trypeta* group.

5. *Facial carina*: (0) with rounded margins, moderately broad dorsally (Figs 3B, I, 4B, D, K); (1) with angular margins, dorsal part strong and slender (Fig. 3D, N). State 1 is unique within the *Trypeta* group.
6. *Parafacial*: (0) narrow, at most 0.5× as wide as flagellomere 1; (1) broad, at least as wide as flagellomere 1. This character varies among other genera of the *Trypeta* group.
7. *Scutal microtrichia*: (0) entirely microtrichose; (1) bare except anterior and lateral margins; (2) with large medial bare area, at most extending to presutural supra-alar seta. States 1 and 2 are rare within other genera of the *Trypeta* group, and thus are probably apomorphic within *Trypeta*.
8. *Acrostichal setae*: (0) present; (1) absent. State 1 is unique within the *Trypeta* group.
9. *Basal scutellar setae*: (0) long, at least 2× as long as scutellum; (1) short, at most 1.5× as long as scutellum. State 1 is rare in other genera of the *Trypeta* group, and is probably apomorphic within *Trypeta*. The apical scutellar setae vary similarly in length, but this character is not used in the analysis because it appears correlated with the length of the basal scutellar setae.
10. *Vein R_{4+5} distal to crossvein R-M*: (0) with <8 tiny setulae; (1) with >10 tiny setulae. This character varies among other genera of the *Trypeta* group.
11. *Vein M ratio (distance along vein M between crossveins R-M and DM-Cu/distance between crossveins R-M and BM-Cu)*: (0) >0.5 (Fig. 6A–S); (1) <0.3 (Fig. 6T, U). This character varies among other genera of the *Trypeta* group.
12. *Apical extension of cell bcu*: (0) at most 1.5× as long as basal width (Fig. 6A–R); (1) at least 2× as long as basal width (Fig. 6S–U). State 1 is rare in other genera of the *Trypeta* group, and is probably apomorphic within *Trypeta*.
13. *Alula microtrichia*: (0) entirely microtrichose, except along basal fold; (1) mostly to entirely bare. State 1 is rare in other genera of the *Trypeta* group, and is probably apomorphic within *Trypeta*.
14. *Wing with oblique band from crossvein BM-Cu across base of cell dm to posterior margin in distal half of cell cu_1* (Fig. 6S–U): (0) absent; (1) present. State 1 is unique within the *Trypeta* group.
15. *Anterior apical band*: (0) undivided, usually extended into cell r_1, but not beyond level of DM-Cu (Figs 6G– J, R); (1) divided by hyaline area into spot in cell r_1 (often extended into cell r_{2+3}) and larger apical spot (Fig. 6M–Q); (2) with only an apical spot, usually not reaching apex of R_{2+3}, apex of r_1 hyaline (Fig. 6A, B, D, E); (3) slender and extended basally beyond level of DM-Cu (Fig. 6S–U). All of these states occur within other genera of the *Trypeta* group, although state 1 is the most common.
16. *Subapical band*: (0) anterior end not basally curved (Figs 5, 6O–R); (1) anterior end basally curved (Fig. 6S); (2) fused with discal band, single band covering pterostigma, R-M, and DM-Cu (Fig. 6T, U). Wing patterns are highly variable in other genera of the *Trypeta* group, but none has states 1 or 2.
17. *Abdominal tergite 4*: (0) entirely yellow brown; (1) with dark lateral marks of various sizes (Fig. 7). This character varies among other genera of the *Trypeta* group.
18. *Apex of lateral surstylus in lateral view*: (0) more or less truncated (Figs 8A, E, G, 9A, C); (1) sharply pointed (Fig. 8B–D, F, 9B, D–G). State 1 is unique within the *Trypeta* group.
19. *Lateral prensiseta*: (0) present; (1) absent (Fig. 9D, G). State 1 is unique within the *Trypeta* group.
20. *Subapical lobe of glans*: (0) trumpet-shaped (Fig. 10A, B); (1) reduced to short flap, not trumpet-shaped (Figs 10C–H, 11). State 1 is unique within the *Trypeta* group.
21. *Internal sculpture pattern of round granulation on medial sclerite of glans*: (0) granules larger and spaced by at least the diameter of each granule; (1) extensive with tiny granules closely packed together (Fig. 10H). State 1 is unique within the *Trypeta* group.
22. *Internal sculpture pattern of elongated granulation on dorsal sclerite of glans*: (0) extensive (Figs 10A–D, F, H, 11B, F–I); (1) largely reduced (Figs 10E, G, 11A, C–E). State 1 is rare in other genera of the *Trypeta* group, and is probably apomorphic within *Trypeta*.
23. *Dorsal marginal setae of oviscape*: (0) inconspicuous, or at most 3× as long as nearby setulae (Fig. 12A, B, F, G); (1) single distinct pair (Fig. 12D, E, K, M, O); (2) 2 distinct pairs (Fig. 12H, I); (3) 4 distinct pairs (Fig. 12C, N). States 1, 2, and 3 are unique within the *Trypeta* group.